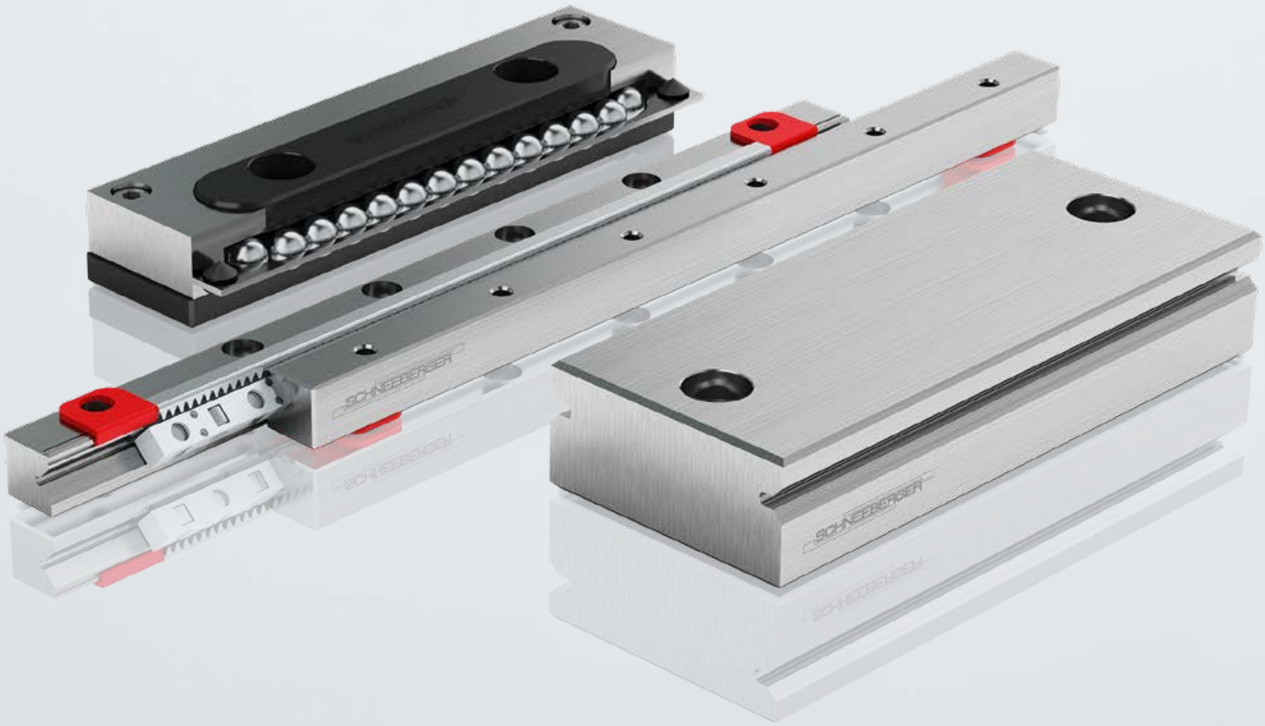
SCHNEEBERGER
LINEAR TECHNOLOGY



LINEAR BEARINGS

and Recirculating Units

Product catalog 2020

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1 Foreword

In 1923 SCHNEEBERGER laid the foundation of what is today global linear motion technology. SCHNEEBERGER standards then made it possible to build linear guideways, which in terms of loading capacity, reliability and cost-effectiveness set new standards and soon defined what is today the definitive industry standard.

The same principles that were the foundation for our success, informing our way of thinking and acting apply today as previously: the spirit of innovation, a no-compromise approach to quality and the ambition to deliver to our customers products that are technically and economically superior again and again. Both then and today the name SCHNEEBERGER throughout the world is synonymous with modern linear guide technology. Our core competencies, development, production and application know-how make us a well respected business partner. Together with our committed, customer-oriented and unique employees, we are global leaders.

We have developed a broad and deep expert knowledge from many successful projects in a variety of industries. Together with customers we evaluate the best products from the standard range or define project-specific solutions. Thanks to many years of experience and consistent focus on linear motion technology, we have been able to continuously develop our products and solutions and so provide our customers with technical advantages.

State-of-the-art production technologies and highly specialised employees are responsible for the highest possible quality standards. Our production is subject to stringent specifications and tests.

Our high-precision products are suitable for use in a variety of fields of application:
- Biotechnology
- Semiconductor industry
- Laboratory automation
- Medical technology
- Pick and place machines
- Measuring technology
- Micro-automation
- Nanotechnology
- Surface finishing
- Optics industry
- Processing machines for the micro-sector

Our linear guideways and recirculating units are available in many designs, sizes and standard lengths and depending on the specific application can be equipped with balls, rollers or needles.

The use of SCHNEEBERGER linear guideways and recirculating units makes it possible to build cost-effective linear guideway systems. The strengths of our products:
- High level of smoothness and consistent accuracy
- No stick-slip effect
- Rapid travelling speeds
- Minimal wear
- High level of reliability
- High rigidity
- High load carrying capacity
- Used in vacuum and clean room

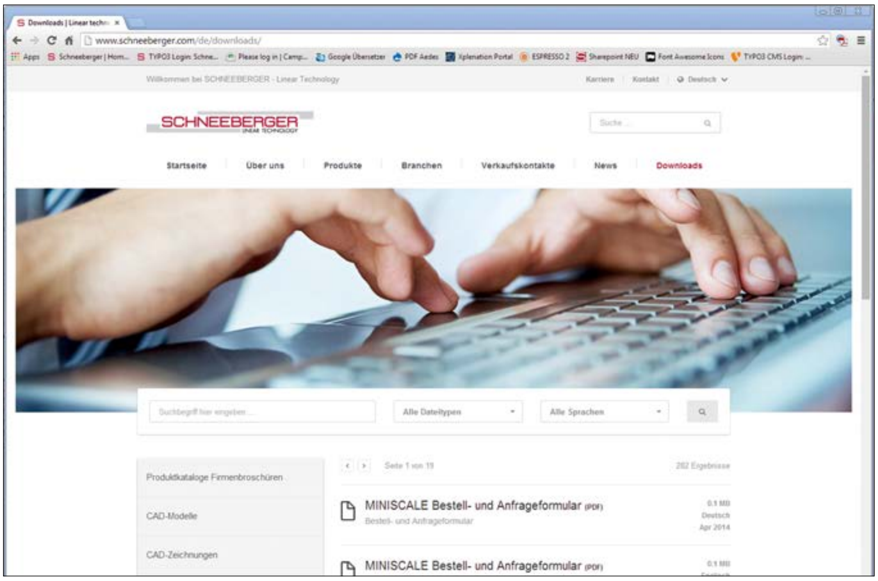
Our skilled and committed employees will be pleased to advise you at any time on how to develop your applications.

2 Useful guidelines

2.1 2D- and 3D-drawings

Drawings and models are available on the Cadenas Part Server free of charge in all formats.

The required download area with additional product information can be found on the web site www.schneeberger.com.



Our website www.schneeberger.com

2.2 Regulations governing substances and limit values

The products presented in this catalogue do not include any forbidden substances based on the RoHs guidelines and do not release chemical substances in accordance with the REACH guidelines.

2.3 Index and type designations

2 Useful guidelines

2.4 Description of the units

Name	Description	Unit
a	Event probability	Factor
C_0	Static loading capacity	N
C	Dynamic loading capacity for a 100'000 m travel distance C corresponds to C100 for SCHNEEBERGER products	N
C_{100}	Dynamic loading capacity for a 100'000 m travel distance	N
C_{50}	Dynamic loading capacity for a 50'000 m travel distance	N
C_{eff}	Effective load carrying capacity per rolling element	N
Dw	Diameter of the rolling element	mm
F	Operating load, load of the linear guideway	N
F_1... F_2...	Individual loads	N
f_h	Hardness factor	Factor
f_t	Temperature factor	Factor
H	Stroke	mm
K	Cage length	mm
K_t	Load-bearing (cage) length	mm
L	Length	mm
L	Nominal service life	m
L_1 ... L_2 ...	Partial travel distance	mm
M	Moment load longitudinally and laterally	Nm
Mds	Tightening torque	Ncm
M_L	Permissible moment load longitudinally and laterally	Nm
M_Q	Permissible moment load transversely	Nm
P	Dynamically equivalent load	N
P_L	Dynamically equivalent load longitudinally	N
P_Q	Dynamically equivalent load transversely	N
Pvs	Infeed force	N
Q	Medium linear guideway distance	mm
R_A	Number of rolling elements	Item
R_T	Number of load-bearing rolling elements	Item
R_{Tmin}	Correction factor	Factor
t	Cage division	mm
t_2	Length of the middle section	mm
w	Distance Cage start to the middle of the first rolling element	mm
δS	Deformation of the connecting structure	µm
δA	Deformation of the rolling element including the guide rail	µm

3 Overview of product

Linear guideway type R

Linear guideway type RD

Linear guideway type RN

Linear guideway type RNG

Linear guideway type N/O

Linear guideway type M/V

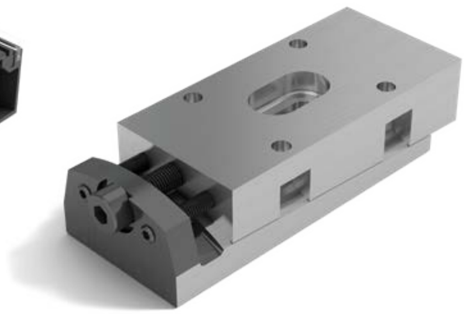
Recirculating unit type SK

Recirculating unit type SKD

Recirculating unit type SKC

Recirculating unit type SR

Recirculating unit type NRT

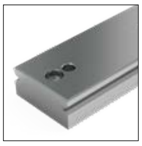


Preload wedge NRV

3 Overview of product

3.1 An overview of linear guideways

The SCHNEEBERGER range of linear guideways offers you perfect solutions for your specific applications.



	R	RD	RN	RNG	N/O	M/V
For features and dimension table, see chapter	5.1	5.1	5.2	5.3	5.4	5.5

Assessment of the advantages

Parameter: displacement force & high level of smoothness						
- balls	++++	++++	n/a	n/a	n/a	n/a
- rollers	+++	+++	+++	+++	n/a	n/a
- needles	n/a	n/a	n/a	n/a	++	++

Parameter: High loading capacity						
- balls	+	+	n/a	n/a	n/a	n/a
- rollers	++	++	+++	+++	n/a	n/a
- needles	n/a	n/a	n/a	n/a	++++	++++

Legend:

++++ best choice
+++
++
+ good choice
n/a not available

Performance parameters						
Maximum acceleration in m/s²	50	50	50	50	50	50
Maximum acceleration with cage control in m/s²	n/a	n/a	300	300	200	200
Maximum speed in m/s	1	1	1	1	1	1
Maximum speed with cage control in m/s	n/a	n/a	1	1	1	1
Quality classes	see chapter 9.1	see chapter 9.1	see chapter 9.1	see chapter 9.1	see chapter 9.1	see chapter 9.1
Operating temperature in degrees Celsius	-40° C – +80° C	-40° C – +80° C	-40° C – +80° C	-40° C – +80° C	-40° C – +80° C	-40° C – +80° C

Material (standard)						
Rail made of tool steel, hardness in HRC	58 - 62	58 - 62	58 - 62	58 - 62	58 - 62	58 - 62
Rolling element made of tool steel, hardness in HRC	58 - 64	58 - 64	58 - 64	58 - 64	58 - 64	58 - 64

Material (corrosion-resistant)						
Rail made of tool steel, hardness in HRC	min. 54	min. 54	min. 54	min. 54	min. 54	min. 54
Rolling element made of tool steel, hardness in HRC	min. 56	min. 56	min. 56	min. 56	min. 56	min. 56

n/a not available

3 Overview of product

The following special versions do not apply in respect of every rail cross-section or every rail length. For details and technical information, see chapter 7.






Special versions	Order code (5)	R	RD	RN	RNG	N/O	M/V
Precision in special quality (1)	SQ	✓	✓	✓	✓	✓	✓
Precision in super special quality (1)	SSQ	✓	✓	✓	✓	✓	✓
Linear guideways made of corrosion-resistant steel (2)	RF	✓	✓	✓	✓	✓	✓
Run-ins rounded	EG	✓	✓	✓	✓	✓	✓
Prepared for roller cage type EE	EE	✓	✓	n/a	n/a	n/a	n/a
Multi-part linear guideways	ZG	✓	✓	✓	✓	✓	✓
Pair of height-matched guideways	HA EHA	✓	✓	✓	✓	✓	✓
DURALLOY® coating (3)	DU	✓	✓	✓	✓	✓	✓
DryRunner coating (4)	DR	n/a	n/a	✓	✓	n/a	n/a
Cage control FORMULA-S	KS	n/a	n/a	✓	✓	n/a	n/a
Cage control	KZST	n/a	n/a	n/a	n/a	✓	✓
Various versions of fixing holes	V, G, D	✓	✓	✓	✓	✓	✓

(1) There are limitations relating to:
- corrosion-resistant steel
- coatings
- maximum rail length

(2) There are limitations relating to:
- Maximum rail length (in normal quality as well as in options SQ and SSQ)
- Hardness of the steel. This is reduced to a min. 54 HRC, which affects the service life of the linear guideway

(3)
- The special versions ZG and SSQ are not possible
- Special quality (SQ) only on request

(4)
- DryRunner® supports operating without a lubricant. Due to increased cage creep we recommend the additional use of the option «cage control FORMULA-S»
- Options ZG and SSQ cannot be supplied. Option SQ on request
- There are limitations concerning maximum rail length
- This option is not available for the sizes RN/RNG 9 and RN/RNG 12

(5)
- Order reference, see p.139

n/a not available

3.2 An overview of recirculating units

The SCHNEEBERGER range of recirculating units offers you perfect solutions for your specific applications

	SK	SKD	SKC	SR	NRT
For features and dimension table, see chapter 6	6.1	6.1	6.2	6.3	6.4

Assessment of the advantages

Parameter: Low displacement force & high level of smoothness					
- balls	+++	++++	++++	n/a	n/a
- rollers	n/a	n/a	n/a	++	++

Parameter: High loading capacity					
- balls	++	++	+		n/a
- rollers	n/a	n/a	n/a	+++	++++

Legend:

++++ best choice
+++
++
+ good choice
n/a not available

Performance parameters

Max. acceleration in m/s²	50	50	50	50	50
Max. speed in m/s	2	2	2	2	1
Operating temperature in degrees Celsius	-40° C – +80° C	-40° C – +80° C	-150° C to +200° C	-40° C – +80° C	-40° C – +80° C

Material (standard)

Supporting structure of tool steel, hardness in HRC	58 - 62	58 - 62	58 - 62 coated	58 - 62	58 - 62
Rolling element made of tool steel, hardness in HRC	58 - 64	58 - 64 (Damping elements made of plastic)	n/a	58 - 64	58 - 64
Rolling element made of ceramic (Balls made of Teflon® are situated between the ceramic balls)	n/a	n/a	✓	n/a	n/a
Redirection unit	Size 1, 2, 9 and 12 made of anodized aluminium Sizes 3 and 6 depending on the length made of plastic or aluminium	Depending on the length made of plastic or aluminium	tool steel, coated	Depending on the length made of plastic or aluminium	Plastic

Special versions

Detailed technical information on the options listed below can be found in chapter 8

	Order code	SK	SKD	SKC	SR	NRT
Matched (height-matched)	GP	✓	✓	✓	✓	✓
Connection for centralised lubrication	ZS	n/a	n/a	n/a	n/a	✓

n/a not available

3 Overview of product

3.3 Earlier generations of the product

Examples of earlier generations of the product, which we are also pleased to manufacture for you today:

Linear guideway type W/Z

Linear guideway type L/M or J/K

Linear guideway type A

Linear guideway type B

Linear guideway type C

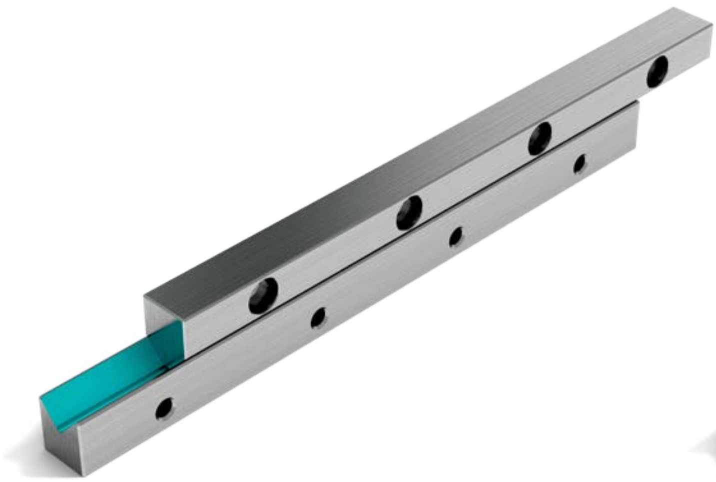
Linear guideway type D

Linear guideway type E

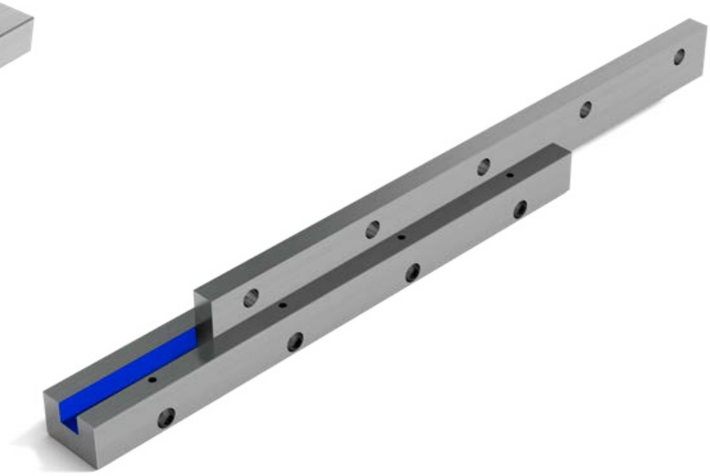
3.4 Slideways

In some applications slideways/slide bearings are more suitable than roller-contact bearings. For such applications SCHNEEBERGER produces steel strips, which are produced with a slideway lining selected by the customer (e.g. Turcite B, Glycodur or Ampco) and then re-ground.

The slideways can be supplied in standardised dimensions for the roller-contact bearing or on a customer-specific basis too.



Slideways

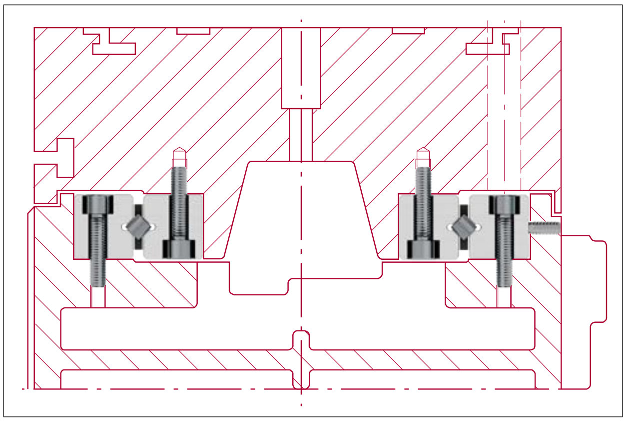


Flat strips

3.5 Application-specific solutions

Our linear guideways can be universally deployed, but can also be configured on a customer-specific basis ex works. Amongst other things, SCHNEEBERGER offers the following services:

– modified standard
– customer-specific design
– special greasing (cleanroom, vacuum, extraordinary temperature ranges, etc.)
– special packaging



Linear guideway for a tool grinding machine table

Precision-grinding on tool grinding machines requires a stick-slip-free and frictionless guideway to allow longitudinal movement of the table.

Possible SCHNEEBERGER products:
4 linear guideways type R 9-800
2 roller cages AC 9 x 33 rollers
8 end pieces GA 9, GB 9

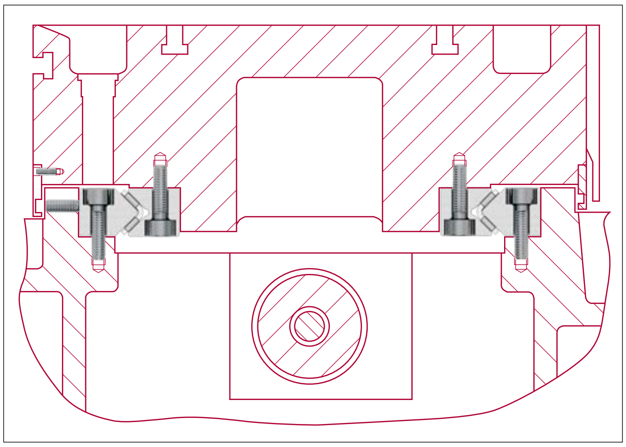
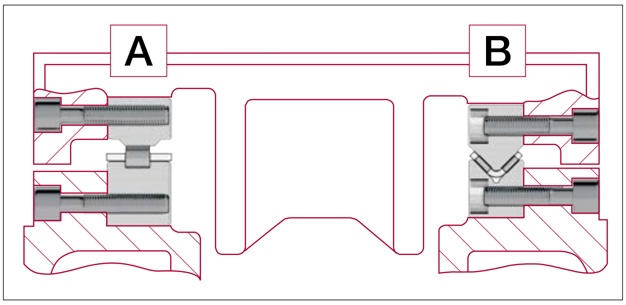


Table bearing for an internal cylindrical grinding machine

Internal cylindrical grinding robots require absolutely zero-backlash table guiding in order to meet the stringent requirements of today's grinding technology.
The grinding table displayed is mounted with type N/O linear guideways whose V-shaped needle cages are connected to an oil impulse lubrication system. This creates the conditions needed to control high table speeds with minimal force applied.

Possible SCHNEEBERGER products:
2 linear guideways type O 2535-1'000
2 linear guideways type N 2535-1'000
2 needle cages HW 20 x 725
4 end pieces GH 2535 without wipers



Open configuration (floating bearings) for heavy surface grinding machine

Surface-mounted roller guides then come into play particularly when large and heavy workpieces are being machined. The weights of table and workpiece and the grinding pressure have a vertical action on the roller guides.

Possible SCHNEEBERGER products:

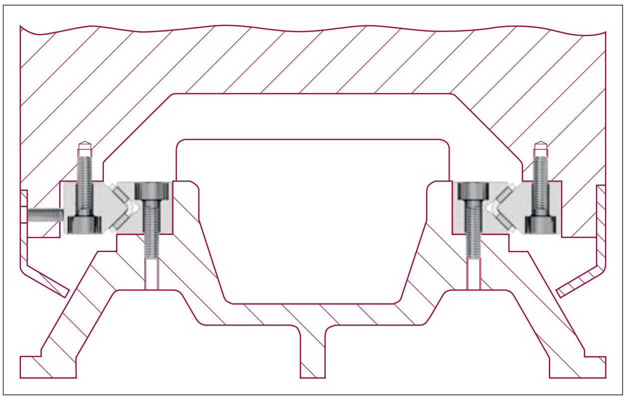
A
1 linear guideway spec. 45 x 35 x 600-EG [1]
1 linear guideway spec. 45 x 42.5 x1'000
1 roller cage H 25 x 810 mm
2 end pieces special

B
1 linear guideway type N 3555-600-EG [1]
1 linear guideway type O 3555-1'000
1 needle cage SHW 30 x 810 mm
2 end pieces GW 3555

Cost-effectiveness, simple assembly and a high level of running accuracy characterise this configuration. Expansion of the table resulting from the effect of heat without limitations is also prevented thanks to characterize expansion options.

Its construction is simple and cost-effective. The N/O linear guideway assumes the task of being the lateral linear guideway for the table. As the surface guideway is adjusted level with the N/O, the linear guideway systems can be interchanged - depending on whether the grinding spindle is mounted to the right or left.

[1] see chapter 7



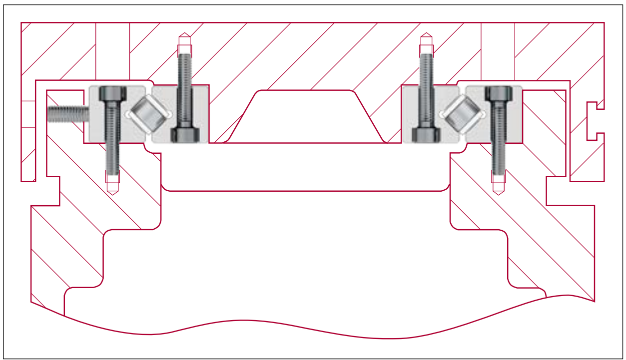
Possible SCHNEEBERGER products:

2 linear guideways N 3045-900
2 linear guideways O 3045-900
2 needle cages SHW 25 x730 mm
8 end pieces GF 3045

Closed V guideway for surface grinding machines

Economic perspectives also determine the structural design of the tables guideways for surface grinding machines. The V-shaped arrangement of the roller guideways creates a closed linear guideway that can be loaded for forces and moments from all directions.

The few components ensure rapid and simple assembly. The stroke and table length ratios are optimal for the use of roller guideways. The basic surfaces of the roof-shaped linear guideways can be machined with extreme efficiency and precision because they are on the same plane. These surfaces also form the basis for achieving high levels of running accuracy.



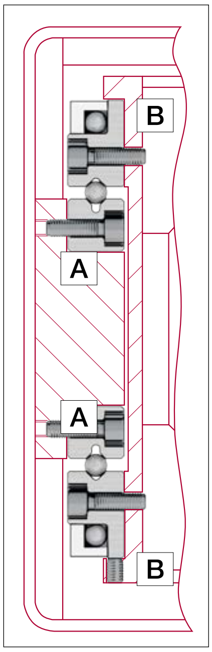
Possible SCHNEEBERGER products:

2 linear guideways RNG 9-700
2 linear guideways RNG 9-450-EG [1]
2 roller cages KBN 9 x 43 rollers
4 end pieces GCN 9

V guideway for heavy tool grinding machines

Tool grinding machines place very high demands on the roller guideway system of the machine table. High level of running accuracy, minimal friction, stick-slip effect and protected arrangement of the roller guideways are the most important requirements.

The RNG roller guideways used here are ideally suited to this task thanks to their high load carrying capacity. The table construction allows drive mechanisms to be accommodated; the upper part of the table can also be installed with great ease. The preload of the linear guideway system can also be easily set subsequently.



Infeed device

The infeed device working in vacuum places high demands on the linear guideway system. A U-shaped support forms the supporting element and also acts as the take-up for the linear guideways. The whole system is made of a non-corrosive material and works vertically with a stroke of 2'700 mm.

Linear guideways, which are assembled in the U-shaped basic component, and 4 type SK rolling elements form the actual guide system. Two of the four rolling elements can be adjusted externally and so support optimal preload setting. All individual components of the rolling elements are made out of stainless steel or aluminium.

Possible SCHNEEBERGER products:

A 4 linear guideways R 9-1400-RF [1]-ZG [1]
B 4 recirculating units SK 9-150-RF [1]

[1] see chapter 7

Patient tables

Highly developed, automatic patient tables are used, amongst other things, in computer tomography (CT), magnetic resonance tomography (MRT) or radiotherapy.

All kinematic processes place the highest demands on the linear guideway systems in terms of running accuracy, smoothness, maintenance-free operation, rigidity, ease of installation and radiation resistance.

Possible SCHNEEBERGER products:
R 9 linear guideways

Microtome

Microtomes are cutting devices use to create wafer-thin sections. They are used for microscopic preparations (for example, biological tissue) or analysis of plastics.

Biological material is normally hardened before being cut by means of fixing and then made sliceable by means of «embedding», i.e. inclusion with a fluid substance such as paraffin or synthetic resin. The thickness of the slices is significantly smaller than the diameter of a human hair and is typically around 1 to 100 µm.

Due to these extraordinary requirements, the most stringent demands in terms of smoothness and precision are placed on the linear guideway systems.

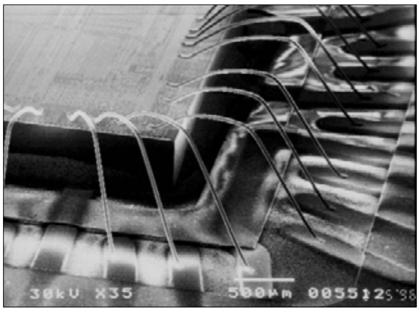
Possible SCHNEEBERGER products:
RNG 4 linear guideways

Wire bonder

Wire bonding is the preferred method for making bonds between an integrated circuit (IC) and a printed circuit board. Wire bonding generally represents the most cost-effective and flexible bonding technology with which the thinnest wires are used for bonding electrical connections.
Aluminium, copper or gold wire from 15 µm in diameter is usually used for this technology. The requirements in respect of the linear guideway system for a wire bonder are correspondingly stringent.

- The highest precision and rigidity
- The highest speeds
- The highest level of smoothness
- The highest level of reliability.

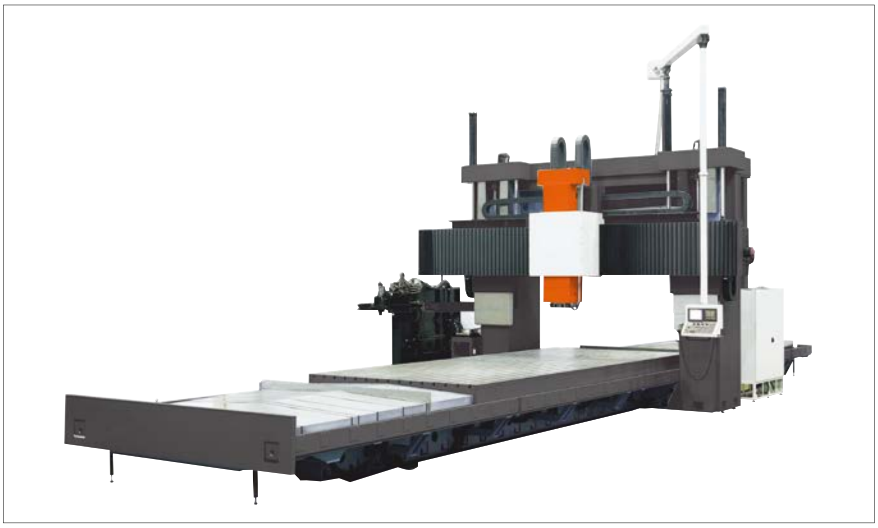
Possible SCHNEEBERGER products:
SCHNEEBERGER supplies prestigious manufacturers of wire bonders with customer-specific linear guideway systems.



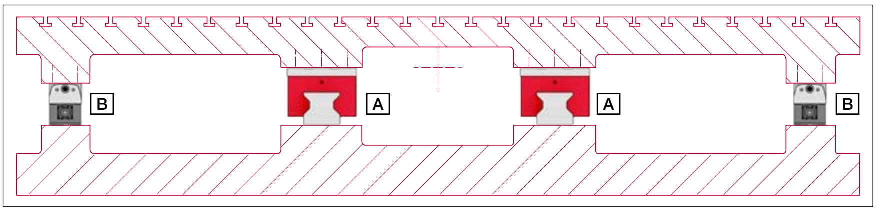
Aluminium wires with a diameter of 25 µm bond the electrodes of microchip with the conductor tracks of a carrier substrate.

Large-scale machining center

To ensure that it is possible to manufacture with high precision under the most stringent loads, rigid and precise linear guideway systems are critical.



Possible SCHNEEBERGER products:
A MONORAIL MR 65
B recirculating unit NRT
with preload wedge NRV



5 Product specifications

5.1 Type R and RD

Type R with balls

Typ R with rollers

Type RD

With its type R, SCHNEEBERGER has developed the first standardized cross roller guide, which has defined the global industry standard.

The RD double V-shaped guide supplements the R linear guideway and supports space-saving and cost-effective solutions.

Type R benchmark data

Track and surface quality
- Finely ground supporting and/or locating surfaces and tracks (90° V-profile)

Materials (standard)
- Rails from through hardened tool steel 1.2842, hardness 58 – 62 HRC
  The sizes R/RD 1 and 2 are made out of tool steel 1.3505
- For non-corrosive guideways tool steel 1.4034 and 1.4112 is used
- Rolling element made of through hardened roller bearing steel, hardness 58 – 64 HRC

Rolling element
- Ball or roller

Speed
- 1 m/s

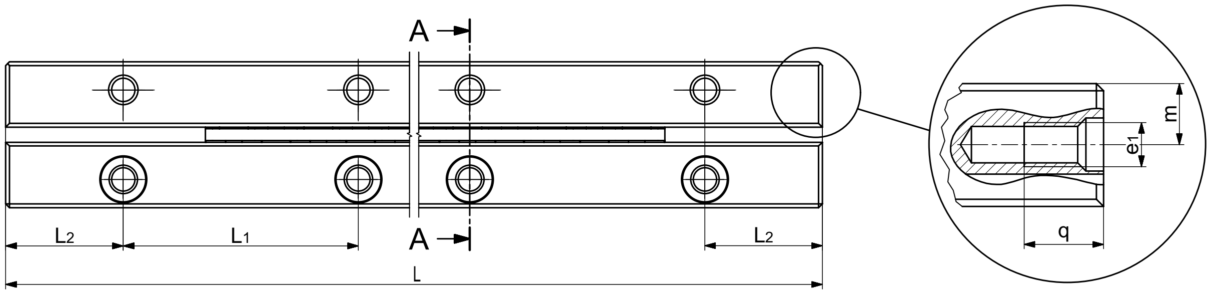
Acceleration
- 50 m/s^2

Accuracy
- R and RD linear guideways are available in three quality classes (see chapter 9)

Operating temperatures
- -40° C to +80° C

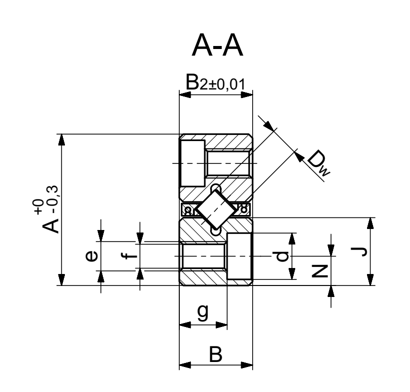
The R and RD design can be combined with the following products:
- recirculating unit type SK, SKC and SR

Dimensions and load capacities type R



Type	Size	L in mm [1]	Weight in g	A	B/B_2 [2]	Dw	J	L_1	L_2	N	d	e	e_1	f	g	m	q	Options (see chapter 7)	Accessories [3]
				mm															
R	1	20	3	8.5	4	1.5	3.9	10	5	1.8	3	M2	M1.6	1.65	2.6	1.9	2.5	SQ SSQ RF EG ZG HA DU	Cage: - AA-RF 1 - AC 1 - AK 1 End screw: - GA 1 End piece: - GB 1
		30	4																
		40	5																
		50	6																
		60	7																
		70	8																
		80	9																
		100	12																
		120	14																
R	2	30	8	12	6	2	5.5	15	7.5	2.5	4.4	M3	M2.5	2.55	4	2.7	3.5	SQ SSQ RF EG ZG HA DU	Cage: - AA-RF 2 - AC 2 - AK 2 End screw: - GA 2 End piece: - GB 2 Fastening screw: - GD 3
		45	11																
		60	14																
		75	17																
		90	20																
		105	23																
		120	26																
		150	34																
		180	40																
R	3	50	23	18	8	3	8.3	25	12.5	3.5	6	M4	M3	3.3	4.8	4.1	7	SQ SSQ RF EG ZG HA DU	Cage: - AA-RF 3 - AC 3 - AK 3 End screw: - GA 3 End pieces: - GB 3 - GC 3 - GC-A 3 Fastening screw: - GD 3 - GD 4
		75	34																
		100	45																
		125	56																
		150	67																
		175	78																
		200	89																
		225	100																
		250	111																
		275	122																
		300	133																
		350	156																
		400	178																
		500	222																
		600	267																

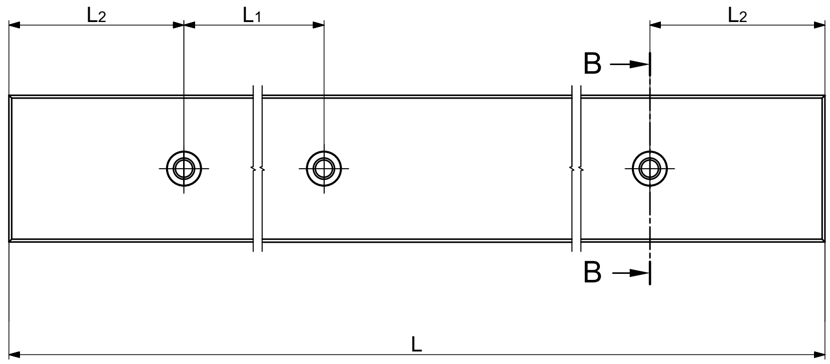
(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 26.
(2) B designates the width of a guideway. B_2 designates the width over both guideways.
(3) Select accessories as follows: Cage type: page 27 and 28, end pieces: pages 29 and, end and fixing screws: page 30



Type	Size	L in mm (1)	Weight in g	A	B/B_2 (2)	Dw	J	L_1	L_2	N	d	e	e_1	f	g	m	q	Options (see chapter 7)	Accessories (3)
				mm															
		100	145																
		150	220																
		200	295																
		250	370																
		300	445																
		350	520																
R	6	400	595	31	15	6	13.9	50	25	6	9.5	M6	M5	5.2	9.8	6.9	9	SQ SSQ RF EG ZG HA DU	Cage: - AA-RF 6 - AC 6 - AK 6 End screw: - GA 6 End pieces - GB 6 - GC 6 - GC-A 6 Fastening screw: - GD 6 - GD 9
		450	670																
		500	745																
		600	895																
		700	1'045																
		800	1'195																
		1'000	1'500																
		200	630																
		300	945																
		400	1'260																
		500	1'575																
		600	1'890																
R	9	700	2'205	44	22	9	19.7	100	50	9	10.5	M8	M6	6.8	15.8	9.8	9	SQ SSQ RF EG EE ZG HA DU	Cage: - AC 9 - AK 9 - EE 9 End screw: - GA 9 End pieces - GB 9 - GC 9 - GC-A 9 Fastening screw: - GD 9 - GD 12
		800	2'520																
		900	2'835																
		1'000	3'150																
		1'100	3'465																
		1'200	3'780																
		1'400	4'410																
		200	1'040																
		300	1'560																
		400	2'090																
		500	2'615																
		600	3'140																
R	12	700	3'665	58	28	12	25.9	100	50	12	13.5	M10	M8	8.5	19.8	12.9	12	SQ SSQ RF EG ZG HA DU	Cage: - AC 12 - AK 12 End screw: - GA 12 End pieces: - GB 12 - GC 12 - GC-A 12 Fastening screw: - GD 12 - GD 15
		800	4'190																
		900	4'715																
		1'000	5'240																
		1'100	5'765																
		1'200	6'290																

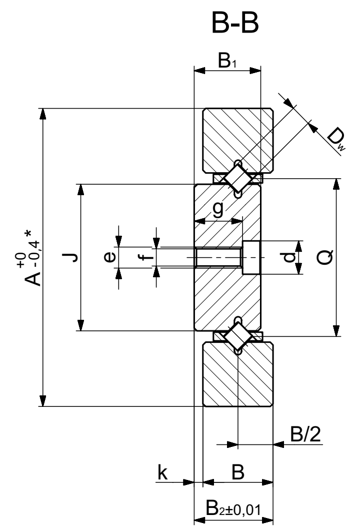
(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 26.
(2) B designates the width of a guideway. B_2 designates the width over both guideways.
(3) Select accessories as follows: Cage type: page 27 and 28, end pieces: pages 29 and, end and fixing screws: page 30

Dimensions and load capacities of type RD



Type	Size	L in mm [1]	Weight in g	A	B	B_1	B_2	Dw	J	L_1	L_2	Q	d	e	f	g	k	Options (see chapter 7)	Accessories [3]
				mm															
RD	1	100	50	22	4	5.5	6	1.5	12.8	25	12.5	13.5	4.4	M3	2.55	3.5	2	SQ SSQ RF EG ZG DU	Cage: - AA-RF 1 - AC 1 - AK 1 Fastening screw: - GD 3
		150	70																
		200	100																
RD	2	200	220	30	6	8.5	9	2	17	50	25	18	6	M4	3.35	5.4	3	SQ SSQ RF EG ZG DU	Cage: - AA-RF 2 - AC 2 - AK 2 Fastening screw: - GD 3 - GD 4
		300	320																
		400	430																
RD	3	300	690	46	8	11.5	12	3	26.6	50	25	28	7.5	M5	4.2	7.3	4	SQ SSQ RF EG ZG DU	Cage: - AA-RF 3 - AC 3 - AK 3 Fastening screw: - GD 4 - GD 6
		400	920																
		500	1150																
		600	1380																
		800	1840																

(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 26.
(2) Positioning hole option available upon customer request (per NZ customer drawing)
(3) Select accessories as follows: Cage type: page 27 and 28, end pieces: pages 29 and, end and fixing screws: page 30



*applies to the mix of type R linear guideways of the same sizes

Type	Size	L in mm	Weight in g	A	B	B_1	B_2	Dw	J	L_1	L_2	Q	d	e	f	g	k	Options (see chapter 7)	Accessories [3]
				mm															
RD	6	On reques	On reques	76	15	19	20	6	41.8	100	50	45	9.5	M6	5.2	13.8	5	SQ SSQ RF EG ZG DU	Cage: - AA-RF 6 - AC 6 - AK 6 Fastening screw: - GD 6 - GD 9
RD	9	Max. 3000	On reques	116	22	27	28	9	67.4	100	50	72	10.5	M8	6.8	20.8	6	SQ SSQ RF EG EE ZG DU	Cage: - AC 9 - AK 9 - EE 9 Fastening screw: - GD 9
RD	12	Max. 3000	On reques	135	28	34	35	12	70.8	100	50	77	13.5	M10	8.5	25.8	7	SQ SSQ RF EG ZG DU	Cage: - AC 12 - AK 12 Fastening screw: - GD 12 - GD 15

[2] Positioning hole option available upon customer request (per NZ customer drawing)
[3] Select accessories as follows: Cage type: page 27 and 28, end pieces: pages 29 and, end and fixing screws: page 30

Maximum lengths for type R

<table>
<tr><th>Type / Size</th><th>Quality class</th><th>Max. lengths in standard material (in mm)</th><th>Max lengths in non-corrosive material (in mm)</th></tr>
<tr><td rowspan="3">R 1</td><td>NQ</td><td rowspan="2">200</td><td rowspan="2">150</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td><td>120</td><td>120</td></tr>
<tr><td rowspan="3">R 2</td><td>NQ</td><td>300</td><td>300</td></tr>
<tr><td>SQ</td><td>300</td><td>300</td></tr>
<tr><td>SSQ</td><td>180</td><td>180</td></tr>
<tr><td rowspan="3">R 3</td><td>NQ</td><td rowspan="2">800</td><td rowspan="3">600</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td><td>600</td></tr>
<tr><td rowspan="3">R 6</td><td>NQ</td><td rowspan="2">1500</td><td>1400</td></tr>
<tr><td>SQ</td><td>1200</td></tr>
<tr><td>SSQ</td><td>1200</td><td>900</td></tr>
<tr><td rowspan="3">R 9</td><td>NQ</td><td rowspan="3">3000</td><td rowspan="3">3000</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
<tr><td rowspan="3">R 12</td><td>NQ</td><td rowspan="3">3000</td><td rowspan="3">3000</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
</table>

Maximum lengths for type RD

<table>
<tr><th>Type / Size</th><th>Quality class</th><th>Max. lengths in standard material (in mm)</th><th>Max lengths in non-corrosive material (in mm)</th></tr>
<tr><td rowspan="3">RD 1</td><td>NQ</td><td rowspan="3">300</td><td rowspan="3">300</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
<tr><td rowspan="3">RD 2</td><td>NQ</td><td rowspan="3">500</td><td rowspan="3">500</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
<tr><td rowspan="3">RD 3</td><td>NQ</td><td rowspan="3">1200</td><td rowspan="3">600</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
<tr><td rowspan="3">RD 6</td><td>NQ</td><td rowspan="2">1500</td><td rowspan="3">900</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td><td>1200</td></tr>
<tr><td rowspan="3">RD 9</td><td>NQ</td><td rowspan="3">3000</td><td rowspan="3">3000</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
<tr><td rowspan="3">RD 12</td><td>NQ</td><td rowspan="3">3000</td><td rowspan="3">3000</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
</table>

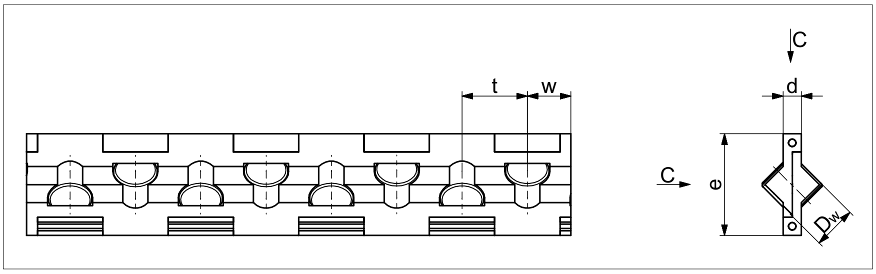
Rail chamfer

The detail of the rail chamfer is shown in the chart below. Please note that the part number and company logo are marked opposite to the datum and supporting surfaces.

Type / Size	Rail chamfer of reference edges in mm
R 1	0.3 x 45°
R 2	0.3 x 45°
R 3	0.6 x 45°
R 6	0.8 x 45°
R 9	0.8 x 45°
R 12	1.0 x 45°

Accessories for type R and RD

Roller cage type AC



Compatible with:
Linear guideway type R and RD,
Sizes 1 to 12

Design:
Rollers fixed in place

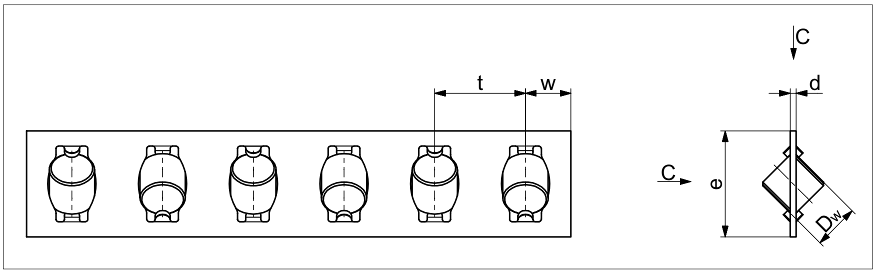
Installation method:
For normal application and certain overrunning cage applications

Material:
Sizes 1, 2 POM
Size 3 PA GF 30%
As from size 6 PA GF 30%, plastic/steel wire composite construction.
The wire is made out of stainless steel.

Option:
Corrosion-resistant rollers

Type	Size	Dw	d	e	t	w	C_{100} per roller in N	C_{50} per roller in N	max. length in mm
AC	1	1.5	0.45	3.5	3	approx. 1.5	50	61.50	80
	2	2	0.75	5	4	approx. 2	85	104.55	170
	3	3	1	7	5	approx. 2.5	130	159.90	1'200
	6	6	2.5	14	9	approx. 6	530	651.90	1'500
	9	9	3.5	20	14	approx. 9	1'300	1599.00	1'500
	12	12	4.5	25	18	approx. 11	2'500	3075.00	1'500

Roller cage type AA-RF



Compatible with:
Linear guideway type R and RD,
Sizes 1, 2, 3 and 6

Design:
Rollers fixed in place

Installation method:
Not suitable as an overrunning cage

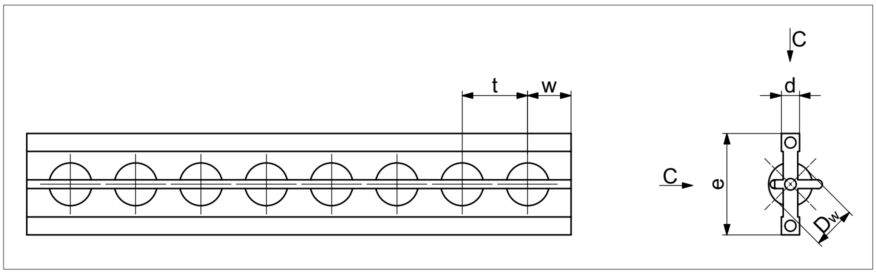
Material:
Cage and rollers made of corrosion-resistant steel and thus also suitable for use in vacuum

Type	Size	Dw	d	e	t	w	$C^{(1)}_{100}$ per roller in N	$C^{(1)}_{50}$ per roller in N	max. length in mm
AA-RF	1	1.5	0.2	3.8	3	approx. 1.5	44	54.12	90
	2	2	0.25	5.9	4	approx. 2	75	92.25	150
	3	3	0.3	7.5	5	approx. 2.5	115	141.45	350
	6	6	0.8	14	12	approx. 6	465	571.95	1'200

(1) The loading capacity C already includes the hardness factor f_H as set out in chapter 12.3

Accessories for type R and RD

Ball cage type AK



Compatible with:
Linear guideway type R and RD,
Sizes 1 to 12

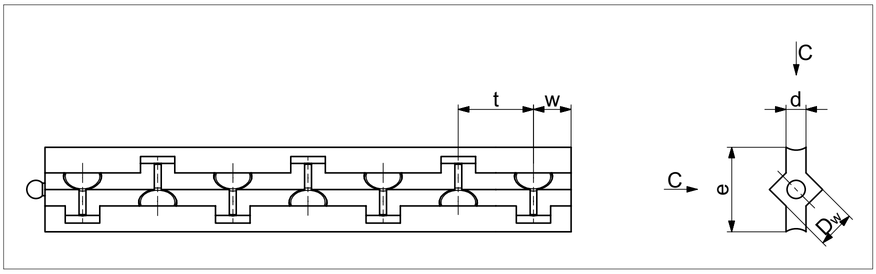
Design:
Balls retained

Installation method:
For normal application and certain overrunning cage applications

Material:
Sizes 1, 2 and 3 POM
As from size 65 PA GF 30%, plastic/steel wire composite construction. The wire is made out of stainless steel.

Type	Size	Dw	d	e	t	w	C_{100} per balls in N	C_{50} per balls in N	max. length in mm
AK	1	1.5	0.45	3.5	2.2	approx. 1.5	9	11.07	80
	2	2	0.75	5	4	approx. 2	15	18.45	100
	3	3	1	7	4.2	approx. 2.5	25	30.75	180
	6	6	2.5	14	9	approx. 6	65	79.95	1'500
	9	9	3.5	20	14	approx. 9	150	184.50	1'500
	12	12	4.5	25	18	approx. 11	260	319.80	1'500

Roller cage type EE



Compatible with:
Linear guideway type R and RD,
Sizes 6

Design:
- The clearances of the guide rails are matched with the EE roller cage, which consequently works as a contaminant wiper. Displacement resistance is increased by the wiper function.
- Rollers fixed in place
- Only used with linear guideways with add-on designation EE
- Select end pieces of type GB or GC

Installation method:
Not suitable as an overrunning cage and for freely surface-mounted guideways

Material:
PE

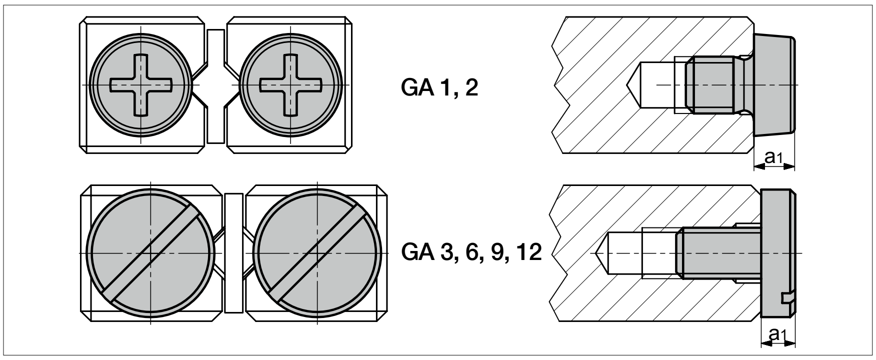
Type	Size	Dw	d	e	t	w	C per roller in N	max. length in mm
EE	6	6	3.2	13.5	12	approx. 6	530	1'500

Accessories for type R and RD

End screws type GA 1 to GA 12

Compatible with:
Linear guideway R 1 to R 12

Installation method:
For horizontal installation
Nicht geeignet für Käfigrückstellung



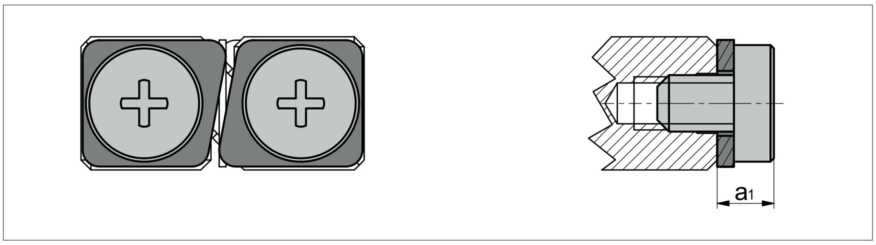
Size	GA 1	GA 2	GA 3	GA 6	GA 9	GA 12
a_1	1.2	1.8	2	3	3	3

End piece type GB 1

Compatible with:
Linear guideway R 1

Installation method:
No restrictions

Scope of supply:
Including end screws



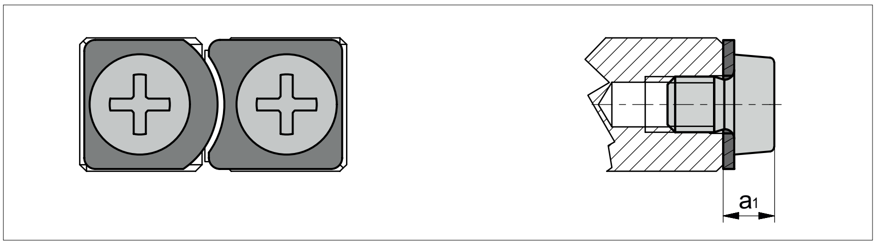
Size	GB 1
a_1	1.7

End piece type GB 2

Compatible with:
Linear guideway R 2

Installation method:
No restrictions

Scope of supply:
Including end screws



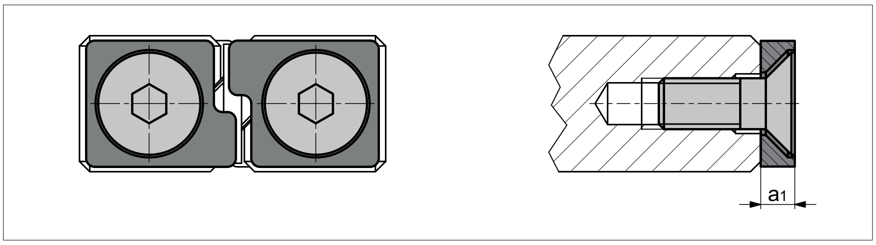
Size	GB 2
a_1	2

End piece type GB 3 to 12

Compatible with:
Linear guideway R 3 to R 12

Installation method:
No restrictions

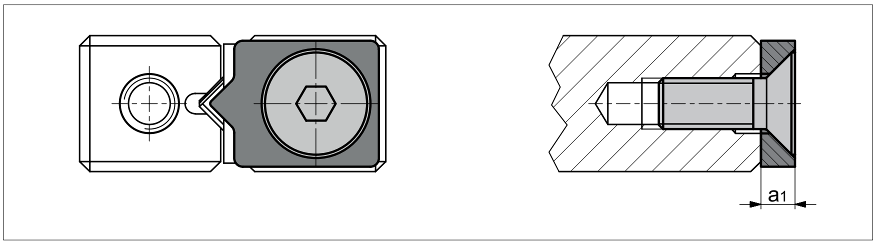
Scope of supply:
Including end screws



Size	GB 3	GB 6	GB 9	GB 12
a_1	2	3	4	5

Accessories for type R and RD

End piece type GC 3 to GC 12



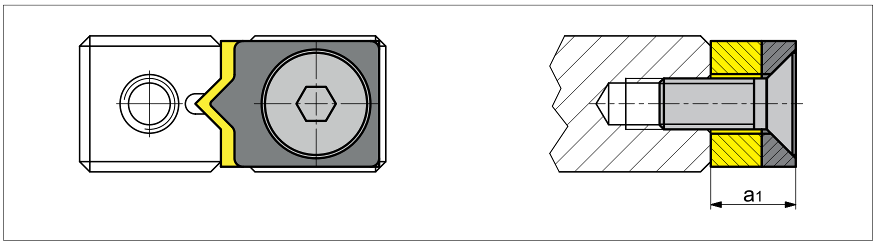
Compatible with:
Linear guideway R 3 to R 12

Installation method:
For overrunning cages

Size	GC 3	GC 6	GC 9	GC 12
a_1	2	3	4	5

Scope of supply:
Including end screws

End piece type GC-A 3 to GC-A 12 (with wipers)



Compatible with:
Linear guideway R 3 to R 12

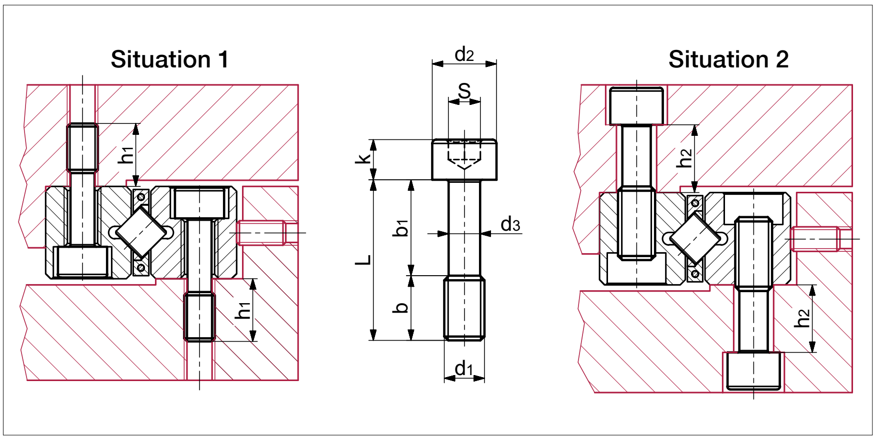
Design:
with felt wiper

Size	GC-A 3	GC-A 6	GC-A 9	GC-A 12
a_1	5	6	7	8

Installation method:
No restrictions

Scope of supply:
Including end screws

Fastening screws with thin shaft type GD 3 to GD 15



Special feature:
To compensate for differences in hole pitches

Type	Size	L	b	b_1	d_1	d_2	d_3	k	s	Max. tightening torque in Ncm*	Compatible with guideways of size (Situation 1)	Compatible with guideways of size (Situation 2)
GD	3	12	5	7	M3	5	2.3	3	2.5	94	R 3 & RD 2	R 2 & RD 1
	4	16	7	9	M4	6.5	3	4	3	221	RD 3	R 3 & RD 2
	6	20	8	12	M5	8	3.9	5	4	463	R 6 & RD 6	RD 3
	9	30	12	18	M6	8.5	4.6	6	5	762	R 9 & RD 9	R 6 & RD 6
	12	40	17	23	M8	11.3	6.25	8	6	1838	R 12 & RD 12	R 9 & RD 9
	15	45	16	29	M10	13.9	7.9	10	8	3674	-	R 12 & RD 12

* Tightening torques apply for materials with a tensile strength of > 360N/mm²

5.2 Type RN

Type RN

The type RN linear guideway is the logical optimised version of the R guideway. It has identical installed dimensions, but due to the optimized contact surfaces of the guideway tracks is, however, higher performing. The reduced gap width between the guide rails also provides better protection against contaminants.

Benchmark data

Track and surface quality

- Finely ground supporting and/or locating surfaces and tracks (90° V-profile)

Materials (standard)

- Rails made of through hardened tool steel 1.2842, hardness 58 – 62 HRC
- For non-corrosive guideways tool steel 1.4034 and 1.4112 is used
- Rolling element made of through hardened roller bearing steel, hardness 58 – 64 HRC

Rolling element

- Roller

Speed

- 1 m/s

Acceleration

- 50 m/s^2
- 300 m/s^2 with cage control

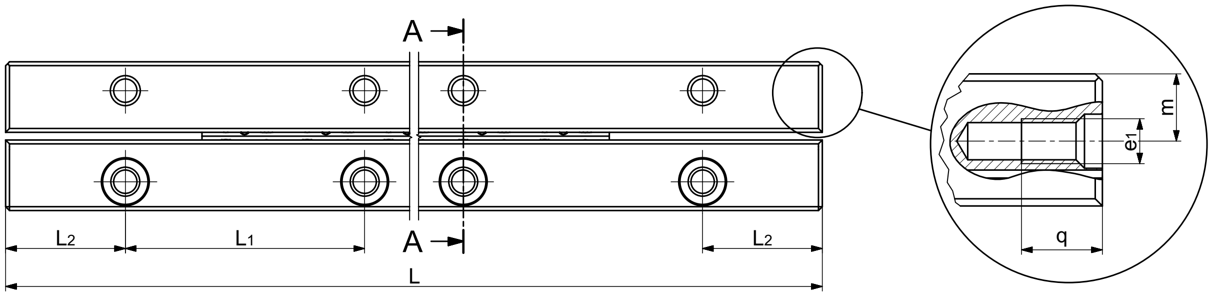
Accuracy

- RN linear guideways are available in three quality classes (see chapter 9)

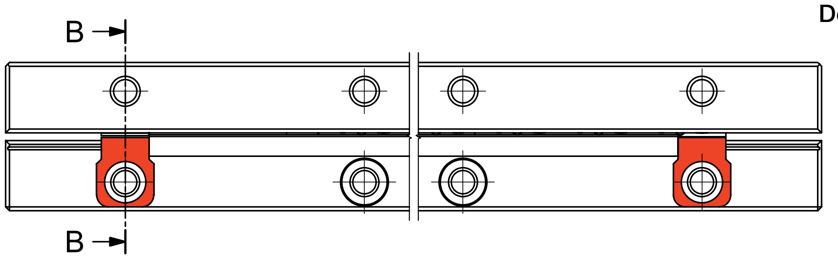
Operating temperatures

- -40° C to +80° C

Dimensions and load capacities of type RN

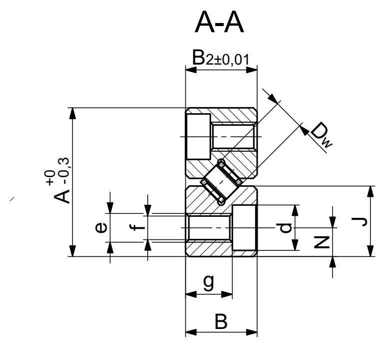


Design with cage control FORMULA-S

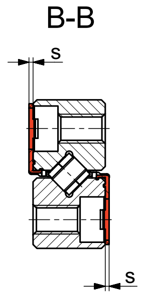


Type	Size	L in mm (1)	Weight in g	A	B/B_2 (2)	Dw	J	L_1	L_2	N	d	e	e_1	f	g	m	q	s	Options (see chapter 7)	Accessories (3)
				mm																
RN	3	50	24	18	8	3	8.7	25	12.5	3.5	6	M4	M3	3.3	4.8	4.8	7	0.85	SQ SSQ RF EG ZG HA DU DR KS	Cage: - KBN 3 - KBS 3 End screw: - GAN 3 Fastening screw: - GD 3 - GD 4
		75	35																	
		100	47																	
		125	59																	
		150	71																	
		175	82																	
		200	94																	
		225	106																	
		250	118																	
		275	129																	
		300	141																	
RN	4	80	62	22	11	4.5	10.5	40	20	4.5	8	M5	M3	4.3	6.9	5.5	7	0.85	SQ SSQ RF EG ZG HA DU DR KS	Cage: - KBN 4 - KBS 4 End screw: - GAN 4 Fastening screw: - GD 4 - GD 6
		120	93																	
		160	124																	
		200	155																	
		240	186																	
		280	217																	
		320	248																	
		360	279																	
		400	310																	
RN	6	100	151	31	15	6.5	14.8	50	25	6	9.5	M6	M5	5.2	9.8	7.5	9	0.85	SQ SSQ RF EG ZG HA DU DR KS	Cage: - KBN 6 - KBS 6 End screw: - GA 6 Fastening screw: - GD 6 - GD 9
		150	226																	
		200	301																	
		250	377																	
		300	452																	
		350	527																	
		400	603																	
		450	678																	
		500	753																	

(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 34.
(2) B designates the width of a guideway. B_2 designates the width over both guideways.
(3) Select accessories as follows: Cage type: page 35, end and fixing screws: page 36



Design with cage control FORMULA-S



Type	Size	L in mm(1)	Weight in g	A	B/B_2(2)	Dw	J	L_1	L_2	N	d	e	e_1	f	g	m	q	s	Options (see chapter 7)	Accessories(3)
				mm																
RN	9	200	659	44	22	9	21.1	100	50	9	10.5	M8	M6	6.8	15.8	11.5	9	-	SQ SSQ RF EG ZG HA DU	Cage: - KBN 9 End screw: - GA 9 Fastening screw: - GD 9 - GD 12
		300	988																	
		400	1318																	
		500	1647																	
		600	1976																	
		700	2306																	
		800	2635																	
RN	12	200	1086	58	28	12	27.6	100	50	12	13.5	M10	M8	8.5	19.8	15	12	-	SQ SSQ RF EG ZG HA DU	Cage: - KBN 12 End screw: - GA 12 Fastening screw: - GD 12 - GD 15
		300	1628																	
		400	2171																	
		500	2714																	
		600	3257																	
		700	3800																	
		800	4342																	
		900	4885																	
		1000	5428																	

(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 34.
(2) B designates the width of a guideway. B_2 designates the width over both guideways.
(3) Select accessories as follows: Cage type: page 35, end and fixing screws: page 36

Maximum lengths for type RN

<table>
<tr><th>Type / Size</th><th>Quality class</th><th>Max. lengths in standard material (in mm)</th><th>Max lengths in non-corrosive material (in mm)</th></tr>
<tr><td rowspan="3">RN 3</td><td>NQ</td><td rowspan="2">800</td><td rowspan="3">600</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td><td>600</td></tr>
<tr><td rowspan="3">RN 4</td><td>NQ</td><td rowspan="2">900</td><td rowspan="2">900</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td><td>600</td><td>600</td></tr>
<tr><td rowspan="3">RN 6</td><td>NQ</td><td rowspan="2">1'500</td><td>1'400</td></tr>
<tr><td>SQ</td><td>1'200</td></tr>
<tr><td>SSQ</td><td>1'200</td><td>900</td></tr>
<tr><td rowspan="3">RN 9</td><td>NQ</td><td rowspan="3">3‘000</td><td rowspan="3">3‘000</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
<tr><td rowspan="3">RN 12</td><td>NQ</td><td rowspan="3">3‘000</td><td rowspan="3">3‘000</td></tr>
<tr><td>SQ</td></tr>
<tr><td>SSQ</td></tr>
</table>

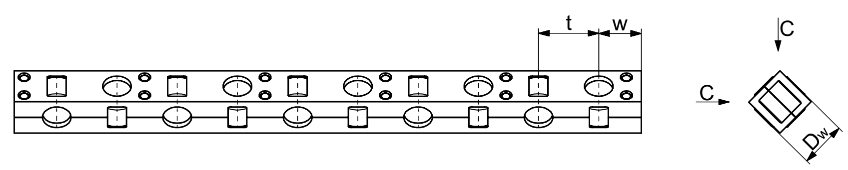
Rail chamfer

The detail of the rail chamfer is shown in the chart below. Please note that the part number and company logo are marked opposite to the datum and supporting surfaces.

Type / Size	Rail chamfer of reference edges in mm
RN 3	0.6 x 45°
RN 4	0.6 x 45°
RN 6	0.8 x 45°
RN 9	0.8 x 45°
RN 12	1.0 x 45°

Accessories for type RN

Roller cage type KBN



Compatible with:
Linear guideway type RN
Sizes 3 to 12

Design:
Rollers fixed in place

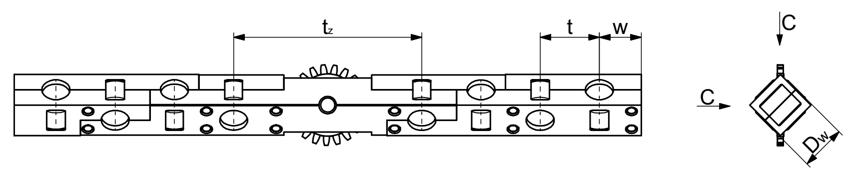
Installation method:
For normal application and certain overrunning cage applications

Material:
POM (Vacuum-compatible up to 10^{-7} mbar)

Option:
Corrosion-resistant rollers

Type	Size	Dw	t	w	C_{100} per roller in N	C_{50} per roller in N	Max. length in mm
KBN	**3**	3	5	approx. 3.5	410	504.3	900
	4	4.5	6.5	approx. 4	850	1045.5	900
	6	6.5	8.5	approx. 5	1'800	2214.0	1'500
	9	9	12	approx. 7.5	3'900	4797.0	1'500
	12	12	15	approx. 9	6'500	7995.0	1'500

Type KBS roller cage for the cage control FORMULA-S



Detailed information on FORMULA-S is listed under chapter 7.8.

Compatible with:
Linear guideway type RN
Sizes 3 to 6

Design:
Rollers fixed in place
With integral pinion

Installation method:
For normal application and certain overrunning cage applications

Material:
POM (Vacuum-compatible up to 10^{-7} mbar)

Option:
Corrosion-resistant rollers

Type	Size	Dw	t	tz	w	$C^{(1)}_{100}$ per roller in N	$C^{(1)}_{50}$ per roller in N	Max. length in mm
KBS	**3**	3	5	18	approx. 3.5	410	504.3	900
	4	4.5	6.5	23	approx. 4	850	1045.5	900
	6	6.5	8.5	27	approx. 5	1'800	2214.0	1'500

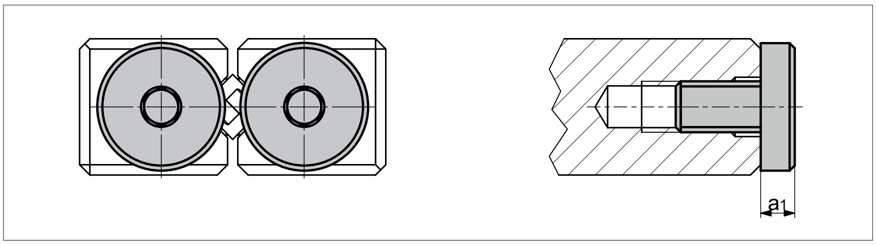
(1) The loading capacity C already includes the hardness factor f_H as set out in chapter 12.3

Accessories for type RN

End screws type GAN

Compatible with:
Linear guideway RN 3 and RN 4

Installation method:
For horizontal installation

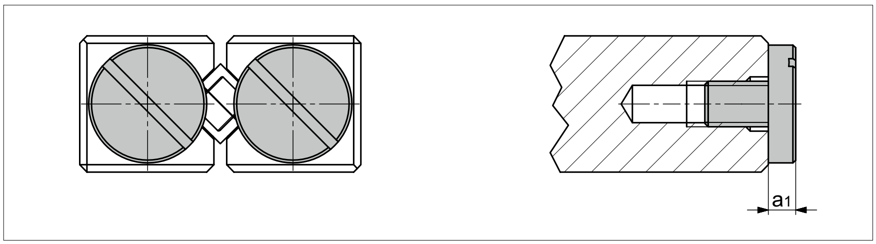


Size	GAN 3	GAN 4
a_1	2	2

End screws type GA

Compatible with:
Linear guideway RN 6 to RN 12

Installation method:
For horizontal installation

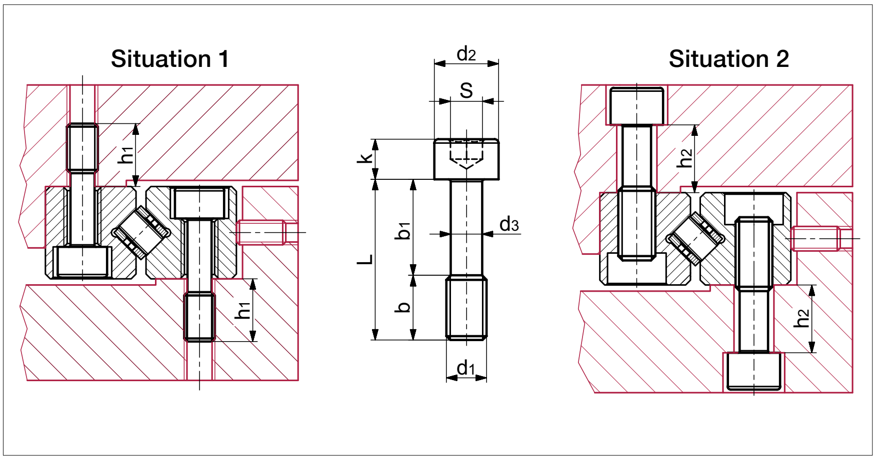


Size	GA 6	GA 9	GA 12
a_1	3	3	3

Fastening screws with thin shaft type GD 3 to GD 15

Special feature:
To compensate for differences in hole pitches

Compatible with:
Linear guideway type RN 3 to RN 12



Type	Size	L	b	b_1	d_1	d_2	d_3	k	s	Max. tightening torque in Ncm(1)	Compatible with linear guideways of size (Situation 1)	Compatible with linear guideways of size (Situation 2)
GD	3	12	5	7	M3	5	2.3	3	2.5	94	RN 3	-
	4	16	7	9	M4	6.5	3	4	3	221	RN 4	RN 3
	6	20	8	12	M5	8	3.9	5	4	463	RN 6	RN 4
	9	30	12	18	M6	8.5	4.6	6	5	762	RN 9	RN 6
	12	40	17	23	M8	11.3	6.25	8	6	1838	RN 12	RN 9
	15	45	16	29	M10	13.9	7.9	10	8	3674	-	RN 12

(1) Tightening torques apply for materials with a tensile strength of > 360N/mm²

5.3 Type RNG

Type RNG

Like type RN, the type RNG linear guideway is based on the type R linear guideway. Like type RN, it has larger contact surfaces for the guideway tracks, which means its performance is significantly enhanced. Compared with types R and RN its cross-section is, however, smaller, which means that it represents a cost-effective solution without compromise.

Benchmark data

Track and surface quality

- Finely ground supporting and/or locating surfaces and tracks (90° V-profile)

Materials (standard)

- Rails from through hardened tool steel 1.2842, hardness 58 - 62 HRC
- For non-corrosive guideways tool steel 1.4034 and 1.4112 is used
- Rolling element made of through hardened roller bearing steel, hardness 58 - 64 HRC

Rolling element

- Roller

Speed

- 1 m/s

Acceleration

- 50 m/s^2
- 300 m/s^2 with cage control

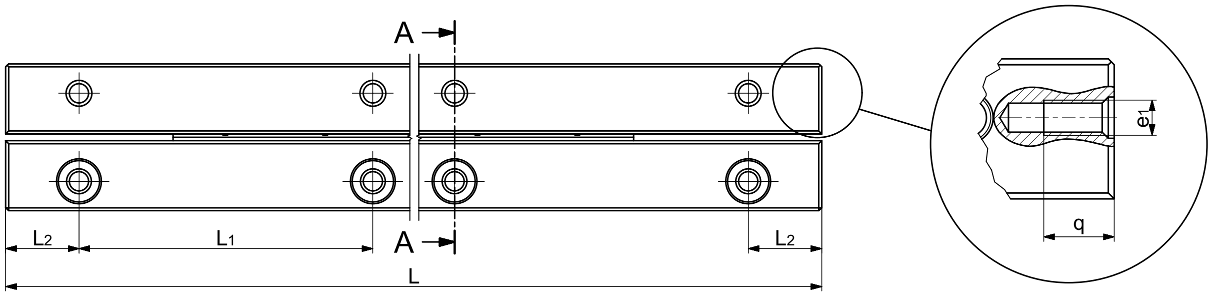
Accuracy

- RNG linear guideways are available in three quality classes (see chapter 9)

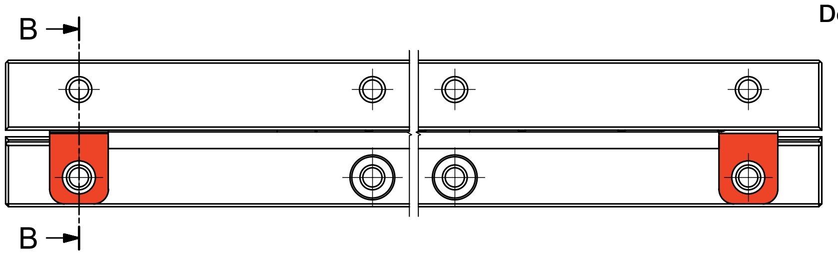
Operating temperatures

- -40° C to +80° C

Dimensions and load capacities of type RNG

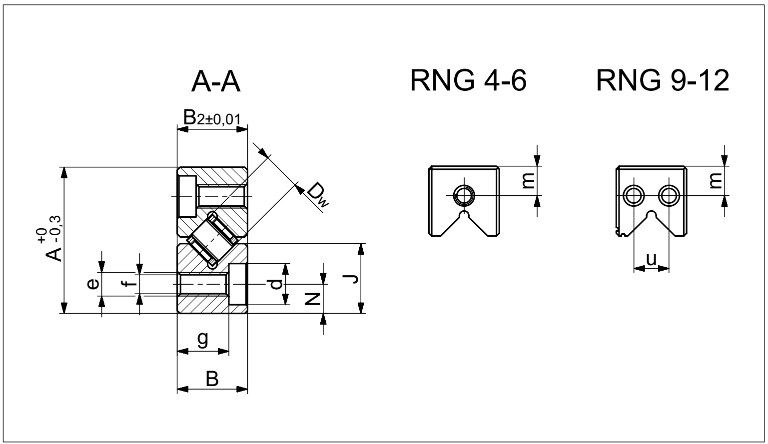


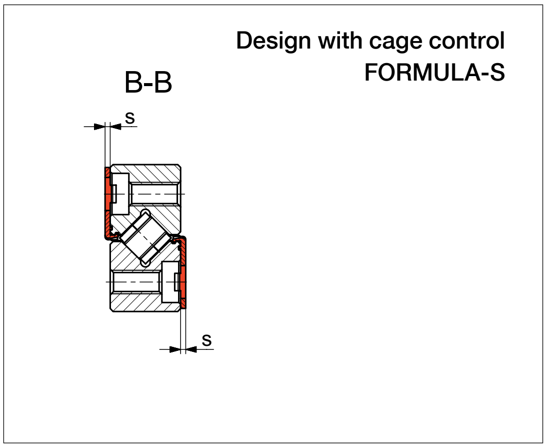
Design with cage control FORMULA-S



Type	Size	L in mm[1]	Weight in g	A	B/B_2[2]	Dw	J	L_1	L_2	N	d	e	e_1	f	g	m	q	u	s	Options (see chapter 7)	Accessories[3]
				mm																	
RNG	4	50	27	19	9	4.5	9	25	12.5	3.5	5.5	M3	M3	2.65	6.3	3.5	6	-	0.85	SQ SSQ RF EG ZG HA DU DR KS	Cage: - KBN 4 - KBS 4 End pieces: - GBN 4 - GCN 4 - GCN-A 4 Fastening screw: - GDN 4 - GDN 6
		75	41																		
		100	55																		
		125	69																		
		150	83																		
		175	97																		
		200	111																		
		225	125																		
		250	139																		
		275	153																		
		300	167																		
RNG	6	100	92	25	12	6.5	12	25	12.5	5	7	M4	M3	3.3	8.8	5	6	-	0.85	SQ SSQ RF EG ZG HA DU DR KS	Cage: - KBN 6 - KBS 6 End pieces: - GBN 6 - GCN 6 - GCN-A 6 Fastening screw: - GDN 6 - GDN 9
		150	138																		
		200	184																		
		250	230																		
		300	276																		
		350	322																		
		400	368																		

(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 40.
(2) B designates the width of a guideway. B_2 designates the width over both guideways.
(3) Select accessories as follows: Cage type: page 41, end pieces: pages 42 and 43, fixing screws: page 43





Type	Size	L in mm [1]	Weight in g	A	B/B_2 [2]	Dw	J	L_1	L_2	N	d	e	e_1	f	g	m	q	u	s	Options (see chapter 7)	Accessories [3]
				mm																	
RNG	9	100	150	33	16	9	16	25	12.5	6	8.5	M5	M3	4.4	11.8	8	6	8	0.85	SQ SSQ RF EG ZG HA DU DR KS	Cage: - KBN 9 - KBS 9 End pieces: - GBN 9 - GCN 9 - GCN-A 9 Fastening screw: - GDN 9
		150	230																		
		200	310																		
		250	390																		
		300	470																		
		350	550																		
		400	630																		
		450	710																		
		500	790																		
RNG	12	200	600	45	22	12	22	50	25	8	12	M8	M5	6.8	15.8	11	7.5	10	-	SQ SSQ RF EG ZG HA DU	Cage: - KBN 12 End pieces: - GBN 12 - GCN 12 - GCN-A 12 Fastening screw: - GDN 12 - GDN 15
		300	905																		
		400	1207																		
		500	1508																		
		600	1810																		
		700	2125																		
		800	2430																		
		900	2734																		
		1000	3038																		

[1] The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 40.
[2] B designates the width of a guideway. B_2 designates the width over both guideways.
[3] Select accessories as follows: Cage type: page 41, end pieces: pages 42 and 43, fixing screws: page 43

Maximum lengths for type RNG

Type / Size	Quality class	Max. lengths in standard material (in mm)	Max lengths in non-corrosive material (in mm)
RNG4	NQ	900	900
	SQ		
	SSQ	600	600
RNG6	NQ	1'500	1'400
	SQ		1'200
	SSQ	1'200	900
RNG9	NQ	3‘000	3‘000
	SQ		
	SSQ		
RNG12	NQ	3‘000	3‘000
	SQ		
	SSQ		

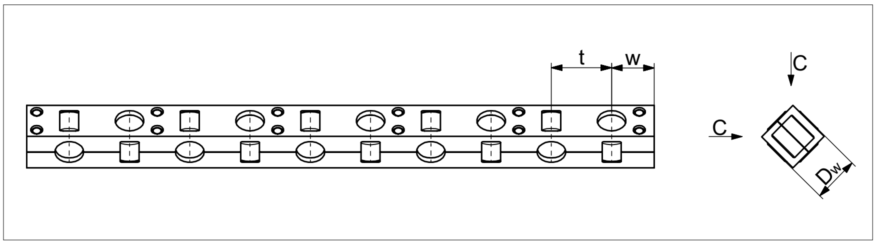
Rail chamfer

The detail of the rail chamfer is shown in the chart below. Please note that the part number and company logo are marked opposite to the datum and supporting surfaces.

Type / Size	Rail chamfer of reference edges in mm
RNG 4	0.4 x 45°
RNG 6	0.5 x 45°
RNG 9	0.8 x 45°
RN 12	0.8 x 45°

Type RNG accessories

Roller cage type KBN



Type	Size	Dw	t	w	C_{100} per roller in N	C_{50} per roller in N	Max. length in mm
KBN	4	4.5	6.5	approx. 4	850	1045.5	900
	6	6.5	8.5	approx. 5	1'800	2214.0	1'500
	9	9	12	approx. 7.5	3'900	4797.0	1'500
	12	12	15	approx. 9	6'500	7995.0	1'500

Compatible with:
Type RNG linear guideway
Sizes 4 to 12

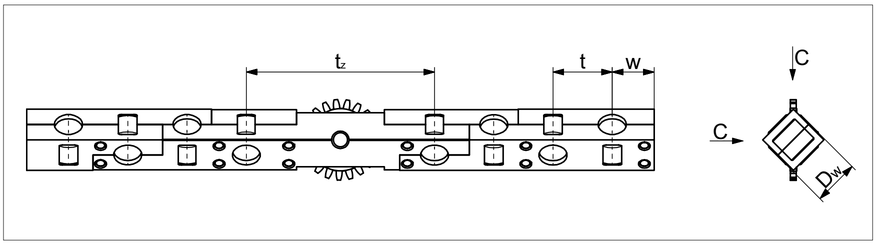
Design:
Rollers fixed in place

Installation method:
For normal application and certain overrunning cage applications

Material:
POM (Vacuum-compatible up to 10^{-7} mbar)

Option:
Corrosion-resistant rollers

Type KBS roller cage for the cage control FORMULA-S



Type	Size	Dw	t	tz	w	C_{100} per roller in N	C_{50} pro Rolle in N	Max. length in mm
KBS	4	4.5	6.5	23	approx. 4	850	1045.5	900
	6	6.5	8.5	27	approx. 5	1'800	2214.0	1'500
	9	9	12	40	approx. 7.5	3'900	4797.0	1'500

Detailed information on FORMULA-S is listed under chapter 7.8.

Compatible with:
Type RNG linear guideway
Sizes 4 to 9

Design:
Rollers fixed in place
With integral pinion

Installation method:
For normal application and certain overrunning cage applications

Material:
POM (Vacuum-compatible up to 10^{-7} mbar)

Option:
Corrosion-resistant rollers

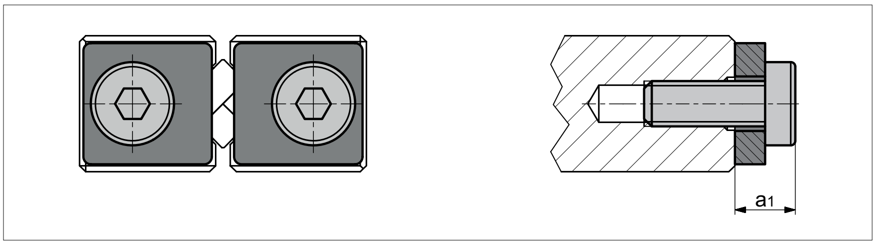
Type RNG accessories

End piece type GBN 4 and GBN 6

Compatible with:
Linear guideway RNG 4 and RNG 6

Installation method:
No restrictions

Scope of supply:
Including end screws



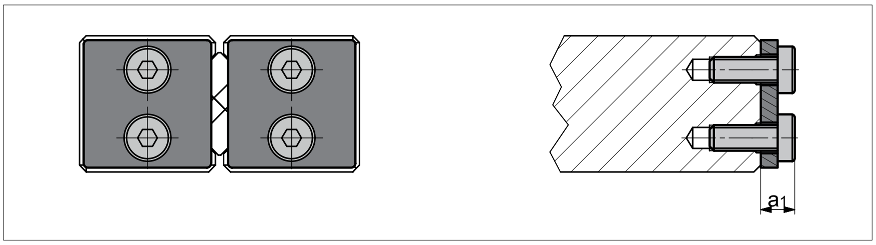
Size	GBN 4	GBN 6
a_1	4	4

End piece type GBN 9 and GBN 12

Compatible with:
Linear guideway RNG 9 and RNG 12

Installation method:
No restrictions

Scope of supply:
Including end screws



Size	GBN 9	GBN 12
a_1	4	8.5

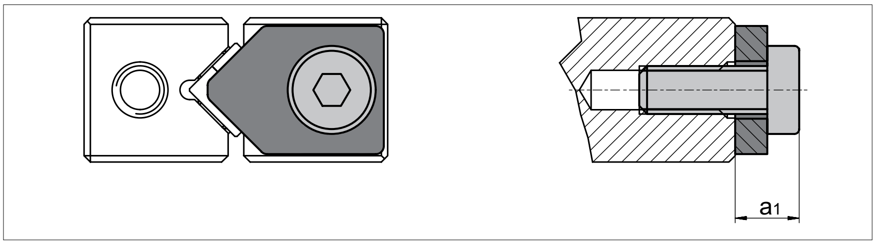
End piece type GCN 4 and GCN 6

Special feature:
For overrunning cage

Compatible with:
Linear guideway RNG 4 and RNG 6

Installation method:
No restrictions

Scope of supply:
Including end screws



Size	GCN 4	GCN 6
a_1	4	4

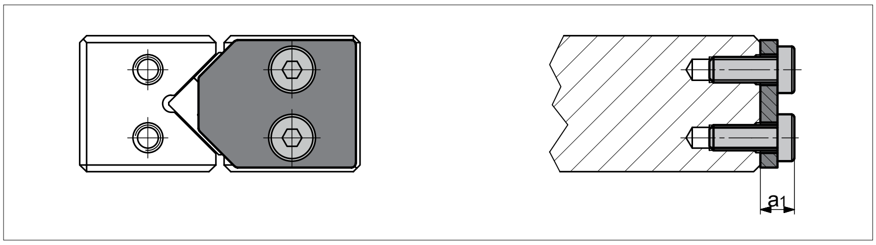
End piece type GCN 9 and GCN 12

Special feature:
For overrunning cage

Compatible with:
Linear guideway RNG 9 and RNG 12

Installation method:
No restrictions

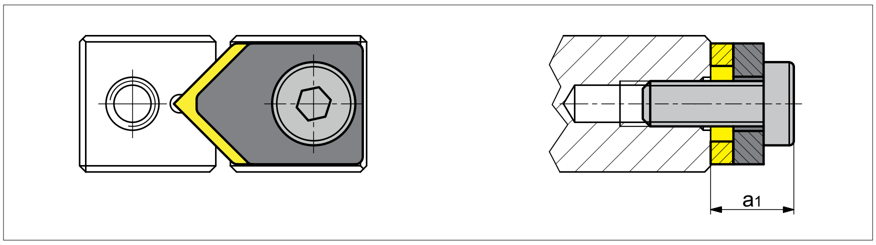
Scope of supply:
Including end screws



Size	GCN 9	GCN 12
a_1	4	8.5

Type RNG accessories

End piece type GCN-A 4 and GCN-A 6



Special feature:
With wipers made of plastic

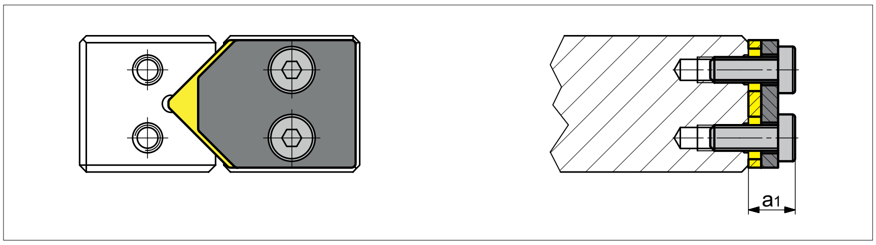
Compatible with:
Linear guideway RNG 4 and RNG 6

Installation method:
No restrictions

Scope of supply:
Including end screws

Size	GCN-A 4	GCN-A 6
a_1	5.5	5.5

End piece type GCN-A 9 and GCN-A 12



Special feature:
With wipers made of plastic

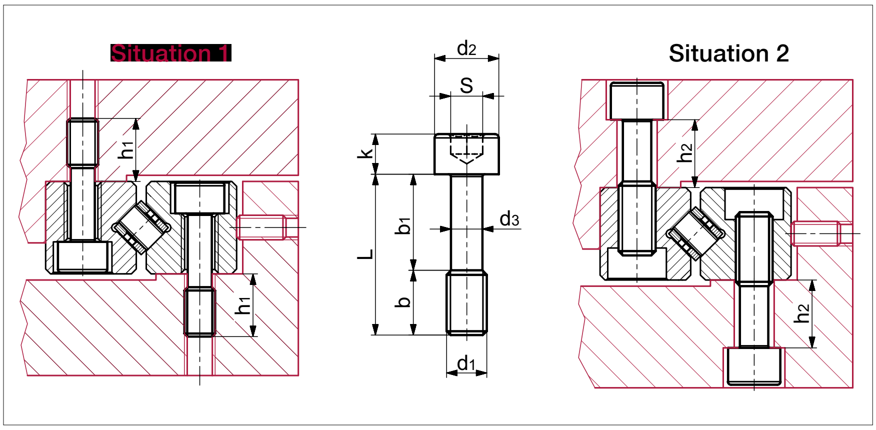
Compatible with:
Linear guideway RNG 9 and RNG 12

Installation method:
No restrictions

Scope of supply:
Including end screws

Size	GCN-A 9	GCN-A 12
a_1	5.5	10

Fastening screws with thin shaft type GDN 4 to GDN 15



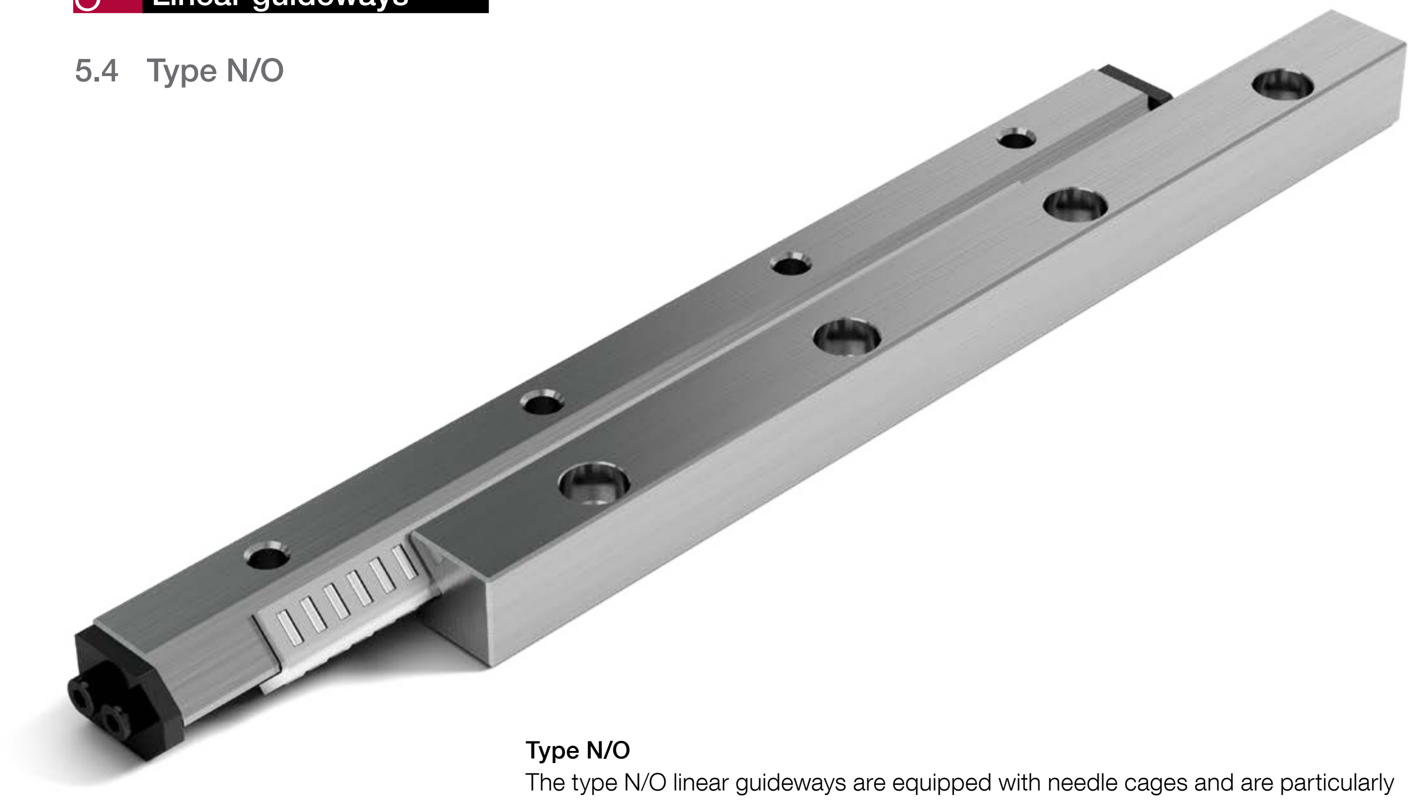
Special feature:
To even out differences in the hole spacings

Compatible with:
Linear guideway type RNG 4 to RNG 12

Type	Size	L	b	b_1	d_1	d_2	d_3	k	s	Max. tightening torque in Ncm(1)	Compatible with linear guideways of size (Situation 1)	Compatible with linear guideways of size (Situation 2)
GDN	4	12	5	7	M2.5	4.5	1.85	2.5	2	54	RNG 4	-
	6	16	5	11	M3	5.5	2.3	3	2.5	94	RNG 6	RNG 4
	9	25	11	14	M4	7	3	4	3	221	RNG 9	RNG 6
	12	30	12	18	M6	10	4.6	6	5	762	RNG 12	-
	15	40	17	23	M8	13	6.25	8	6	1838	-	RNG 12

(1) Tightening torques apply for materials with a tensile strength of > 360N/mm²

5.4 Type N/O



Type N/O

The type N/O linear guideways are equipped with needle cages and are particularly suitable for applications involving high loads. SCHNEEBERGER N/O bearings have a lower moving resistance due to our composite cage.

Benchmark data

Track and surface quality
- Finely ground supporting and/or locating surfaces and tracks (90° V-profile)

Materials (standard)
- Rails from through hardened tool steel 1.2842, hardness 58 – 62 HRC
- For non-corrosive guideways tool steel 1.4034 and 1.4112 is used
- Rolling element made of through hardened roller bearing steel, hardness 58 – 64 HRC

Rolling element
- Needle

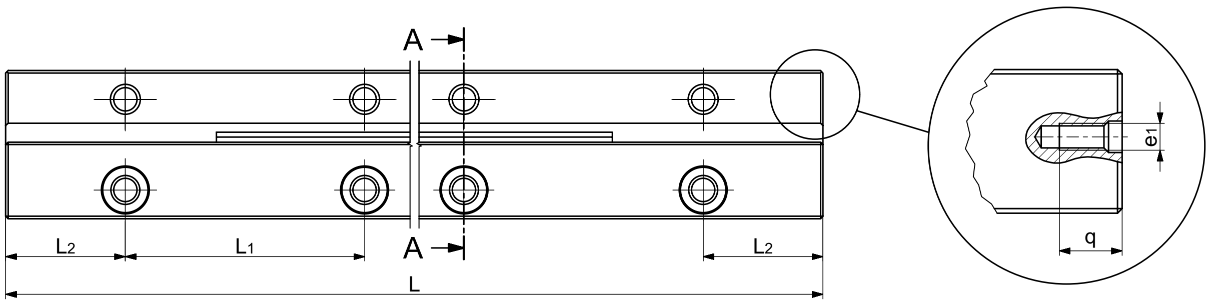
Speed
- 1 m/s

Acceleration
- 50 m/s^2
- 200 m/s^2 with cage control

Accuracy
- Type N/O linear guideways are available in three quality classes (see chapter 9)

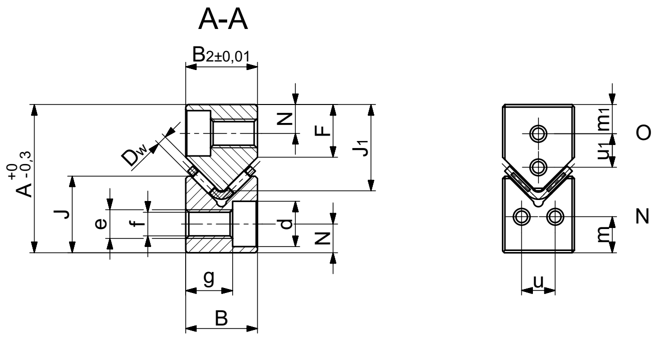
Operating temperatures
- -40° C to +80° C

Dimensions and load capacities of type N/O

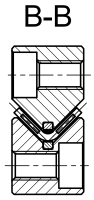


Type	Size	L in mm[1]	Weight in g		A	B/B_2[2]	Dw	F	J	J_1	L_1	L_2	N	d	e	e_1	f	g	m	m_1	q	u	u_1	Options (see chapter 7)	Accessories[3]
			Type N	Type O	mm																				
N/O	62015	100	146	164	31	15	2	11	16	18	50	25	6	9.5	M6	M3	5.2	9.8	7.5	4.5	7	7	7	SQ SSQ RF EG ZG HA DU KZST	Cage: - HW 10 End pieces: - GFN 62015 - GFO 62015 - GH 62015 - GH-A 62015 - GW 62015 - GW-A 62015 Fastening screw: - GD 6 - GD 9
		150	219	246																					
		200	292	328																					
		250	365	410																					
		300	438	492																					
		350	511	574																					
		400	584	656																					
		450	657	738																					
		500	730	820																					
N/O	92025	200	685	695	44	22	2	15	24	24.5	100	50	9	10.5	M8	M4	6.8	15.8	11	6	9	10	10	SQ SSQ RF EG ZG HA DU KZST	Cage: - HW 15 - SHW 15 End pieces: - GFN 92025 - GFO 92025 - GH 92025 - GH-A 92025 - GW 92025 - GW-A 92025 Fastening screw: - GD 9 - GD 2025
		300	1020	1030																					
		400	1360	1373																					
		500	1700	1717																					
		600	2025	2035																					
		700	2360	2370																					
		800	2697	2709																					
N/O	2025	200	924	900	52	25	2	18	28	29	100	50	10	13.5	M10	M6	8.5	16.8	12	7	11	14	11	SQ SSQ RF EG ZG HA DUt KZST	Cage: - SHW 15 End pieces: - GFN 2025 - GFO 2025 - GH 2025 - GH-A 2025 - GW 2025 - GW-A 2025 Fastening screw: - GD 2025 - GD 2035
		300	1386	1350																					
		400	1848	1800																					
		500	2310	2250																					
		600	2772	2700																					
		700	3234	3150																					
		800	3696	3600																					
		900	4158	4050																					
		1000	4620	4500																					
		1100	5082	4950																					
		1200	5544	5400																					
		1400	6468	6300																					
		1600	7392	7200																					

(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 48.
(2) B designates the width of a guideway. B2 designates the width over both guideways.
(3) Select accessories as follows: Cage type: page 49 and 50, end pieces: pages 51 and 52, fixing screws: page 52



Design with cage control (KZST)



Type	Size	L in mm (1)	Weight in g Type N	Weight in g Type O	A	B/B_2 (2)	Dw	F	J	J_1	L_1	L_2	N	d	e	e_1	f	g	m	m_1	q	u	u_1	Options (see chapter 7)	Accessories (3)
					mm																				
N/O	2535	300	1905	1995	62	30	2.5	22	34	35	100	50	12	16.5	M12	M6	10.5	19.8	15	8	11	18	12	SQ SSQ RF EG ZG HA DU KZST	Cage: - HW 20 - SHW 20 End pieces: - GFN 2535 - GFO 2535 - GH 2535 - GH-A 2535 - GW 2535 - GW-A 2535 Fastening screw: -GD 2535 -GD 3035
		400	2540	2660																					
		500	3175	3325																					
		600	3810	3990																					
		700	4445	4655																					
		800	5080	5320																					
		900	5715	5985																					
		1000	6350	6650																					
		1100	6985	7315																					
		1200	7620	7980																					
		1400	8890	9310																					
		1600	10160	10640																					
N/O	3045	400	3660	3460	74	35	3	25	42.5	40	100	50	14	18.5	M14	M6	12.5	22.8	18	10	11	19	16	SQ SSQ RF EG ZG HA DU KZST	Cage: - HW 25 - SHW 25 End pieces: - GFN 3045 - GFO 3045 - GH 3045 - GH-A 3045 - GW 3045 - GW-A 3045 Fastening screw: -GD 3045 -GD 1435
		500	4575	4325																					
		600	5490	5190																					
		700	6405	6055																					
		800	7320	6920																					
		900	8235	7785																					
		1000	9150	8650																					
		1100	1007	9515																					
		1200	10980	10380																					
		1400	12810	12110																					
		1600	14640	13840																					
N/O	3555	500	6156	6088	78	45	3.5	25	45	45	100	50	14	18.5	M14	M6	12.5	32.5	18	12	11	29	20	SQ SSQ RF EG ZG HA DU KZST	Cage: - HW 30 - SHW 30 End pieces: - GFN 3555 - GFO 3555 - GH 3555 - GH-A 3555 - GW 3555 - GW-A 3555 Fastening screw: -GD 3555 -GD 1435
		600	7387	7306																					
		700	8618	8523																					
		800	9850	9741																					
		900	11081	10958																					
		1000	12312	12176																					
		1100	13543	13394																					
		1200	14774	14611																					
		1400	17237	17046																					
		1600	19699	19482																					

(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 48.
(2) B designates the width of a guideway. B2 designates the width over both guideways.
(3) Select accessories as follows: Cage type: page 49 and 50, end pieces: pages 51 and 52, fixing screws: page 52

Maximum lengths type N/O

Type /Size	Quality class (see chapter 9)	Max. lengths in standard material (in mm)	Max lengths in non-corrosive material (in mm)
N/O 62015	NQ	1'500	900
	SQ	1'200	
	SSQ		
N/O 92025	NQ	3'000	3'000
	SQ		
	SSQ		
N/O 2025	NQ	3'000	3'000
	SQ		
	SSQ		
N/O 2535	NQ	3'000	3'000
	SQ		
	SSQ		
N/O 3045	NQ	3'000	3'000
	SQ		
	SSQ		
N/O 3555	NQ	3'000	3'000
	SQ		
	SSQ		

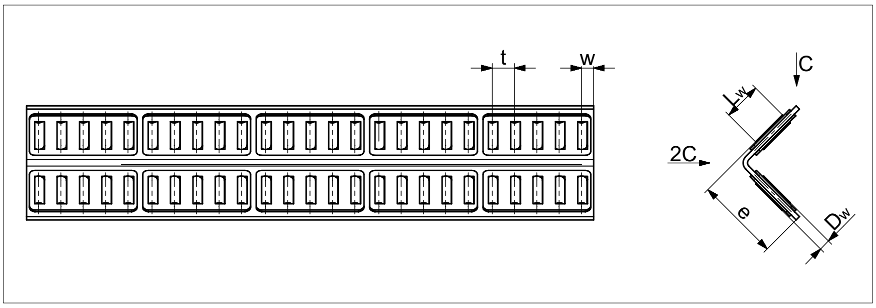
Rail chamfer

The detail of the rail chamfer is shown in the chart below. Please note that the part number and company logo are marked opposite to the datum and supporting surfaces.

Type / Size	Rail chamfer of reference edges in mm
N/O 62015	0.5 x 45°
N/O 92025	0.5 x 45°
N/O 2025	0.5 x 45°
N/O 2535	0.5 x 45°
N/O 3045	1.0 x 45°
N/O 3555	1.0 x 45°

Accessories for type N/O

Needle cage type SHW



Design:
Needles fixed in plastic provides lower displacement forces and smoother running

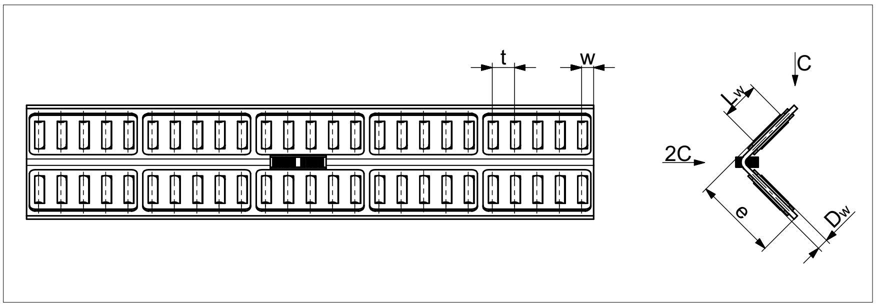
Installation method:
For normal application and certain overrunning cage applications

Material:
Stainless steel and plastic PA 12 GF 30 %

Type	Size	Dw	Lw	e	t	w	C_{100} per needle in N	C_{50} per needle in N	Compatible with linear guideways type	max. length in mm
SHW	**15**	2	6.8	14	4	approx. 2.9	750	922.50	N/O 92025 and 2025	1'500
	20	2.5	9.8	19	4.75	approx. 3.4	1'375	1691.25	N/O 2535	1'500
	25	3	13.8	25	5.2	approx. 3.6	2'350	2890.50	N/O 3045	1'500
	30	3.5	17.8	30	6.1	approx. 4.3	3'600	4428.00	N/O 3555	1'500

Needle cage type SHW with cage control (KZST)

Detailed information on the cage control is listed under Chapter 7.9.



Design:
Needles fixed in plastic. Thus smaller displacement forces and smoother running.

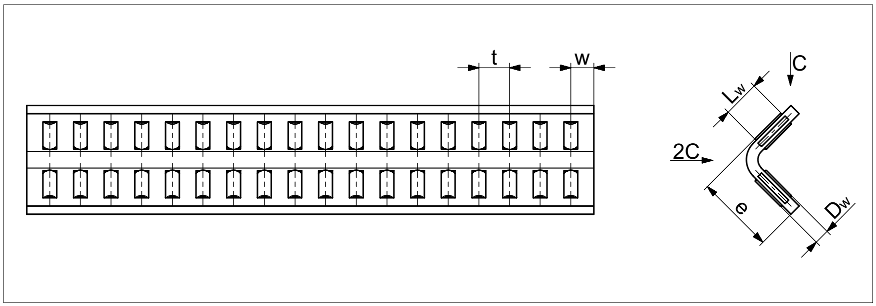
Installation method:
For normal application and certain overrunning cage applications

Material:
Stainless steel and plastic PA 12 GF 30 %

Type	Size	Dw	Lw	e	t	w	C_{100} per needle in N	C_{50} per needle in N	Compatible with linear guideways type	max. length in mm
SHW	**15**	2	6.8	14	4	approx. 2.9	750	922.50	N/O 92025 and 2025	1'500
	20	2.5	9.8	19	4.75	approx. 3.4	1'375	1691.25	N/O 2535	1'500
	25	3	13.8	25	5.2	approx. 3.6	2'350	2890.50	N/O 3045	1'500
	30	3.5	17.8	30	6.1	approx. 4.3	3'600	4428.00	N/O 3555	1'500

Accessories for type N/O

Needle cage type HW



Design:
Needles fixed

Installation method:
For normal application and certain overrunning cage applications

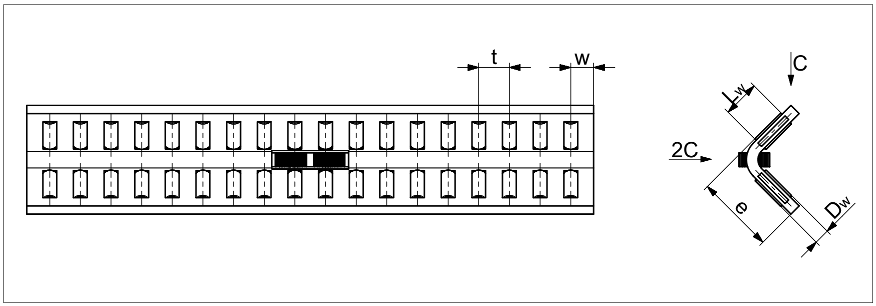
Material:
Standard
- Size HW 10 is made out of tool steel
- All other sizes in aluminium

Optional
- All cages are available in steel

Type	Size	Dw	L_w	e	t	w	C_{100} per needle in N	C_{50} per needle in N	Compatible with linear guideways type	max. length in mm
HW	10	2	4.8	10	4	approx. 3	530	651.90	N/O 62015	1'980
	15	2	6.8	14	4.5	approx. 3.5	750	922.50	N/O 92025	1'950
	16	2	8.8	16	3.8	approx. 2.8	970	1193.10	N/O 2025	1990
	20	2.5	9.8	20	5.5	approx. 4	1'375	1691.25	N/O 2535	1'970
	25	3	13.8	25	6	approx. 4.5	2'350	2890.50	N/O 3045	1'940
	30	3.5	17.8	30	7	approx. 5	3'600	4428.00	N/O 3555	1'980

Needle cage type HW with cage control (KZST)

Detailed information on the cage control is listed under Chapter 7.9.



Design:
Needles fixed

Installation method:
For normal application and certain overrunning cage applications

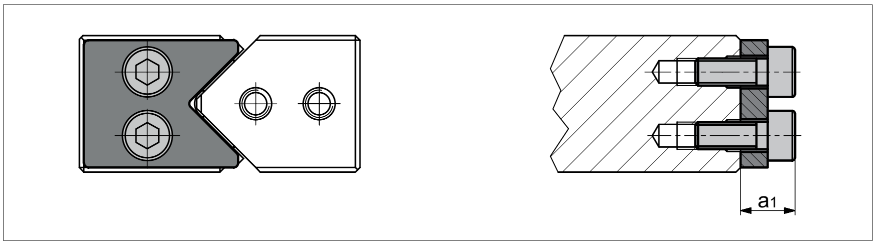
Material:
Standard
- Size HW 10 is made out of tool steel
- All other sizes in aluminium

Optional
- All cages are available in steel

Type	Size	Dw	L_w	e	t	w	C_{100} per needle in N	C_{50} per needle in N	Compatible with linear guideways type	max. length in mm
HW	10	2	4.8	10	4	approx. 3	530	651.90	N/O 62015	1'980
	15	2	6.8	14	4.5	approx. 3.5	750	922.50	N/O 92025	1'950
	16	2	8.8	16	3.8	approx. 2.8	970	1193.10	N/O 2025	1990
	20	2.5	9.8	20	5.5	approx. 4	1'375	1691.25	N/O 2535	1'970
	25	3	13.8	25	6	approx. 4.5	2'350	2890.50	N/O 3045	1'940
	30	3.5	17.8	30	7	approx. 5	3'600	4428.00	N/O 3555	1'980

Accessories for type N/O

End piece type GH



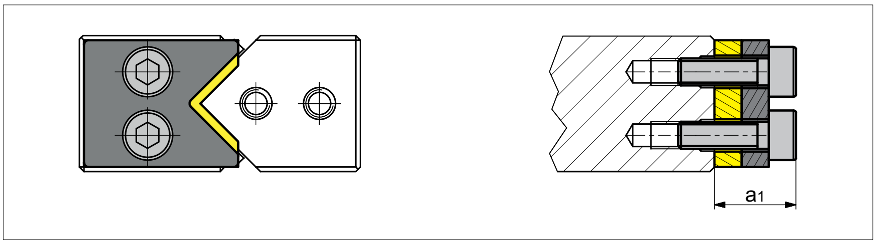
Special feature:
For overrunning cage

Installation method:
No restrictions

Scope of supply:
Including end screws

Size	62'015	92'025	2'025	2'535	3'045	3'555
a_1	6	7	10	10	10	11

End piece type GH-A



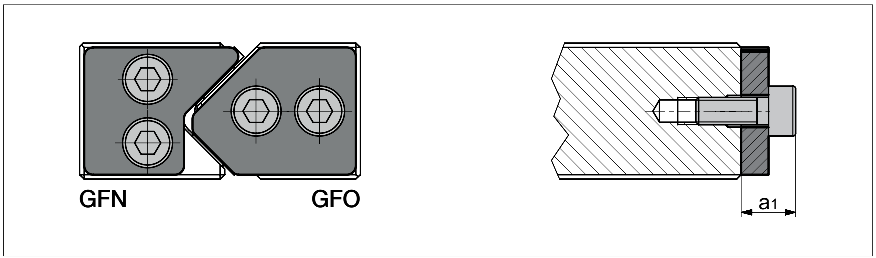
Special feature:
Wipers made of felt

Installation method:
No restrictions

Scope of supply:
Including end screws

Size	62'015	92'025	2'025	2'535	3'045	3'555
a_1	9	10	13	13	13	14

End piece type GFN/GFO

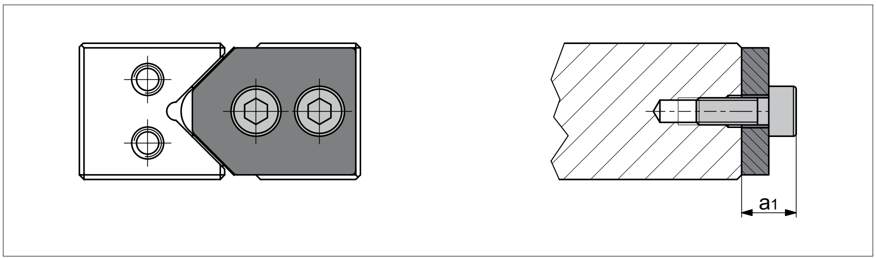


Installation method:
No restrictions

Scope of supply:
Including end screws

Size	62015	92025	2025	2535	3045	3555
a_1	6	7	10	10	10	11

End piece type GW



Special feature:
For overrunning cage

Installation method:
No restrictions

Scope of supply:
Including end screws

Size	62015	92025	2025	2535	3045	3555
a_1	6	7	10	10	10	11

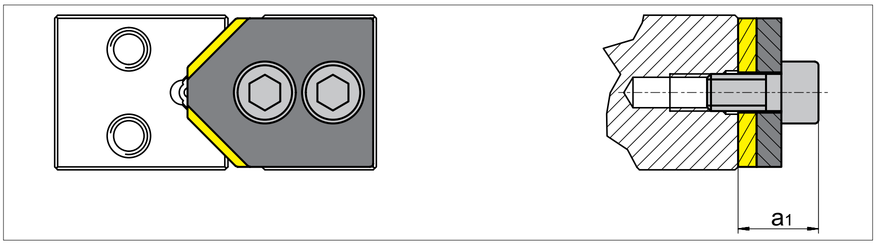
Accessories for type N/O

End piece type GW-A

Special feature:
Felt Wipers

Installation method:
No restrictions

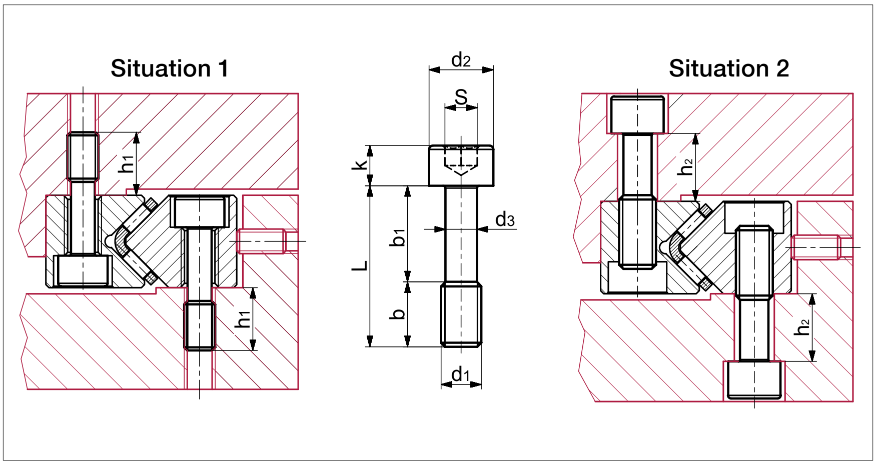
Scope of supply:
Including end screws



Size	62015	92025	2025	2535	3045	3555
a_1	9	10	13	13	13	14

Fastening screws with thin shaft type GD 6 to GD 1435

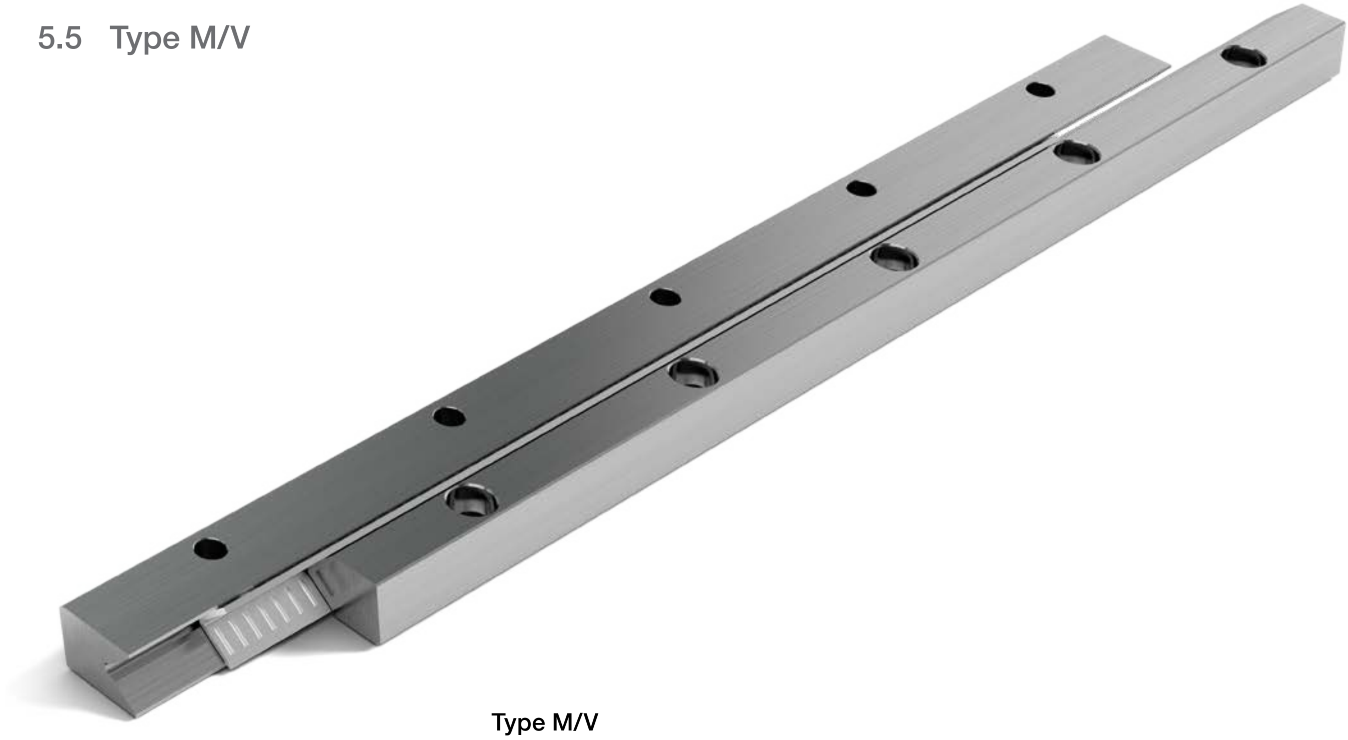
Special feature:
To compensate for differences in hole pitches



Type	Size	L	b	b_1	d_1	d_2	d_3	k	s	Max. tightening torque in Ncm(1)	Compatible with linear guideways type (Situation 1)	Compatible with linear guideways type (Situation 2)
GD	6	20	8	12	M5	8	3.9	5	4	463	N/O 62015	-
	9	30	12	18	M6	8.5	4.6	6	5	762	N/O 92025	N/O 62015
	2025	35	16	19	M8	11.3	6.25	8	6	1838	N/O 2025	N/O 92025
	2535	40	18	22	M10	13.9	7.9	10	8	3674	N/O 2535	N/O 2025
	3045	50	25	25	M12	15.8	9.6	12	10	6579	N/O 3045	N/O 2535
	3555	60	25	35	M12	15.8	9.6	12	12	6579	N/O 3555	N/O 2535
	1435	90	27	63	M14	19.5	11.2	14	12	10631	-	N/O 3045 & N/O 3555

(1) Tightening torques apply for materials with a tensile strength of > 360N/mm^2

5.5 Type M/V



Type M/V

the type M/V linear guideway is similar to type N/O, but differs in its external dimensions. Equipped with needle cages, its is particularly suitable for applications involving a higher load. SCHNEEBERGER M/V bearings have a lower moving resistance due to our composite cage.

Benchmark data

Track and surface quality

- Finely ground supporting and/or locating surfaces and tracks (90° V-profile)

Materials (standard)

- Rails from through hardened tool steel 1.2842, hardness 58 – 62 HRC
- For non-corrosive guideways tool steel 1.4034 and 1.4112 is used
- Rolling element made of through hardened roller bearing steel, hardness 58 – 64 HRC

Rolling element

- Needle

Speed

- 1 m/s

Acceleration

- 50 m/s²
- 200 m/s² with cage control

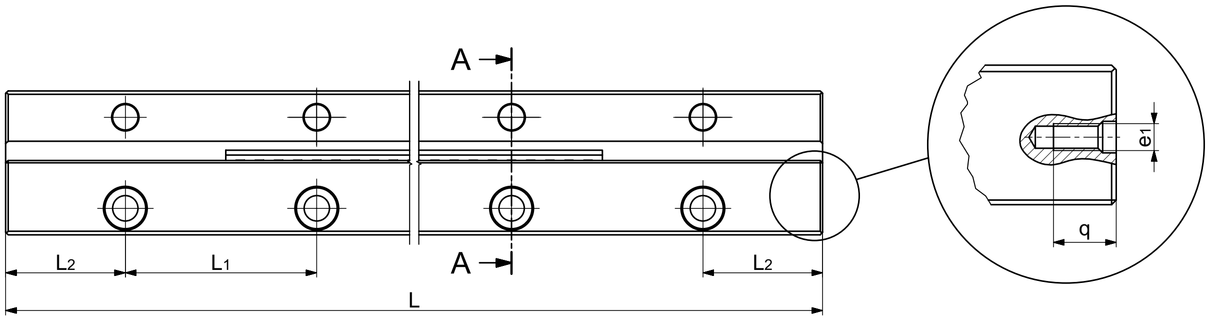
Accuracy

- Type M/V linear guideways are available in three quality classes (see chapter 9)

Operating temperatures

- -40° C to +80° C

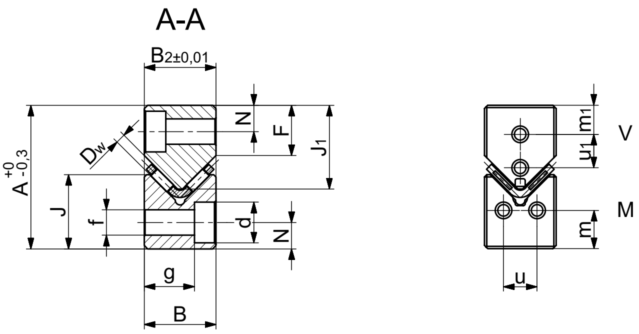
Dimensions and load capacities type M/V



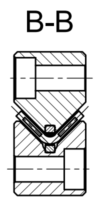
Type	Size	L in mm(1)	Weight in g Type M	Weight in g Type V	A	B/B_2(2)	Dw	F	J	J_1	L_1	L_2	N	a	d	e_1	f	g	m	m_1	q	u	u_1	Options (see chapter 7)	Accessories(3)
					mm																				
M/V	3015	100	136	154	30	15	2	10.5	15.5	17.4	40a)	c)	5.5	0.7	8.5	M3	5.3	10.5	8	5.5	7	7	7	SQ SSQ RF EG ZG HA KZST	Cage: - HW 10 End pieces: - EM 3015 - EV 3015 - EAM 3015 - EAV 3015 Fastening screw: - GD 3015
		150	204	231																					
		200	272	308																					
		300	420	473																					
		400	560	631																					
		500	700	788																					
		600	840	946																					
M/V	4020	100	261	274	40	20	2	13.5	22.5	22	80b)	d)	7.5	1.3	11.5	M5	7.5	13.2	10	5.5	8	11	10.5	SQ SSQ RF EG ZG HA KZST	Cage: - HW 15 - SHW 15 End pieces: - EM 4020 - EV 4020 - EAM 4020 - EAV 4020 Fastening screw: - GD 4020
		150	392	411																					
		200	522	548																					
		300	820	815																					
		400	1093	1087																					
		500	1367	1358																					
		600	1640	1630																					
M/V	5025	100	446	437	50	25	2	17	28	28	80b)	d)	10	1.3	11.5	M6	7.5	18.2	12	7	9	13	13	SQ SSQ RF EG ZG HA KZST	Cage: - HW 15 - HW 16 - SHW 15 End pieces: - EM 5025 - EV 5025 - EAM 5025 - EAV 5025 Fastening screw: - GD 5025
		200	893	874																					
		300	1339	1311																					
		400	1786	1748																					
		500	2232	2185																					
		600	2678	2622																					
		700	3125	3059																					
		800	3571	3496																					
		900	4018	3933																					
		1000	4464	4370																					

a) for the 100 mm length, the following applies: L_1 = 35 mm (2 x)
b) for the length 100 mm, the following applies: L_1 = 50 mm
c) min. 15 mm
d) min. 20 mm

(1) The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 56.
(2) B designates the width of a guideway. B_2 designates the width over both guideways.
(3) Select accessories as follows: Cage type: page 57 and 58, end pieces: pages 59, fixing screws: page 60



Design with cage control (KZST)



Type	Size	L in mm[1]	Weight in g Type M	Weight in g Type V	A	B/B_2[2]	Dw	F	J	J_1	L_1	L_2	N	a	d	e_1	f	g	m	m_1	q	u	u_1	Options (see chapter 7)	Accessories[3]
					mm																				
M/V	6035	200	1450	1510	60	35	2.5	20	35	35.5	100	50	11	1.3	15	M6	10	26	14	8	9	20	18	SQ SSQ RF EG ZG HA KZST	Cage: - HW 20 - SHW20 End pieces: - EM 6035 - EV 6035 - EAM 6035 - EAV 6035 Fastening screw: - GD 6035
		300	2176	2265																					
		400	2901	3020																					
		500	3626	3775																					
		600	4351	4530																					
		700	5076	5285																					
		800	5802	6040																					
		900	6527	6795																					
		1000	7252	7550																					
M/V	7040	200	1934	2008	70	40	3	24	40	41.5	100	50	13	1.3	18.5	M6	12.5	29	16	10	9	20	20	SQ SSQ RF EG ZG HA KZST	Cage: - HW 25 - SHW 25 End pieces: - EM 7040 - EV 7040 - EAM 7040 - EAV 7040 Fastening screw: - GD 7040
		300	2807	3019																					
		400	3743	4025																					
		500	4678	5032																					
		600	5821	6038																					
		700	6791	7044																					
		800	7499	8051																					
		900	8436	9057																					
		1000	9374	10321																					
M/V	8050	300	4014	4271	80	50	3.5	26	45	48	100	50	14	1.3	20	M6	14	37	20	10	9	30	25	SQ SSQ RF EG ZG HA KZST	Cage: - HW 30 - SHW 30 End pieces: - EM 8050 - EV 8050 - EAM 8050 - EAV 8050 Fastening screw: - GD 8050
		400	5352	5694																					
		500	6690	7118																					
		600	8290	8544																					
		700	9672	9968																					
		800	10700	11530																					
		900	12038	12822																					
		1000	13375	14247																					

[1] The lengths listed are standard; other lengths are of course available. The maximum lengths are listed on page 56.
[2] B designates the width of a guideway. B_2 designates the width over both guideways.
[3] Select accessories as follows: Cage type: page 57 and 58, end pieces: pages 59, fixing screws: page 60

Maximum lengths type M/V

Type / Size	Quality class	Max. lengths in standard material (in mm)	Max lengths in non-corrosive material (in mm)
M/V 3015	NQ	1'500	900
	SQ	1'200	
	SSQ		
M/V 4020	NQ	3'000	3'000
	SQ		
	SSQ		
M/V 5025	NQ	3'000	3'000
	SQ		
	SSQ		
M/V 6035	NQ	3'000	3'000
	SQ		
	SSQ		
M/V 7040	NQ	3'000	3'000
	SQ		
	SSQ		
M/V 8050	NQ	3'000	3'000
	SQ		

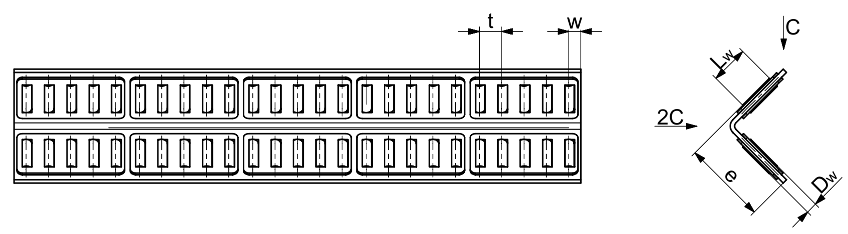
Rail chamfer

The detail of the rail chamfer is shown in the chart below. Please note that the part number and company logo are marked opposite to the datum and supporting surfaces.

Type / Size	Rail chamfer of reference edges in mm
M/V 3015	0.5 x 45°
M/V 4020	1.3 x 45°
M/V 5025	1.3 x 45°
M/V 6035	1.3 x 45°
M/V 7040	1.3 x 45°
M/V 8050	1.3 x 45°

Accessories type M/V

Needle cage type SHW



Compatible with:
Linear guideway type M/V

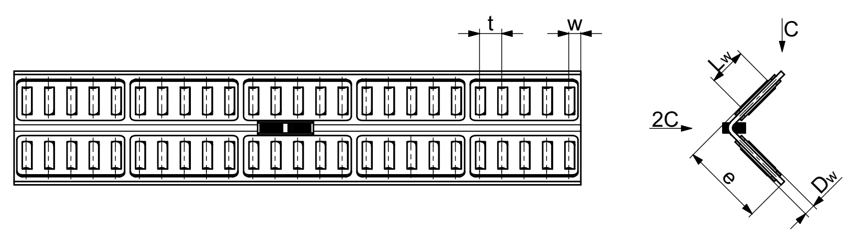
Design:
Needles fixed in plastic provides lower displacement forces and smoother running

Installation method:
For normal application and certain overrunning cage applications

Material:
Stainless steel and plastic PA 12 GF 30 %

Type	Size	Dw	Lw	e	t	w	C_{100} per needle in N	C_{50} per needle in N	Compatible with linear guideways type	max. length in mm
SHW	15	2	6.8	14	4	approx. 2.9	750	922.50	M/V 4020 and M/V 5025	1'500
	20	2.5	9.8	19	4.75	approx. 3.4	1'375	1691.25	M/V 6035	1'500
	25	3	13.8	25	5.2	approx. 3.6	2'350	2890.50	M/V 7040	1'500
	30	3.5	17.8	30	6.1	approx. 4.3	3'600	4428.00	M/V 8050	1'500

Needle cage type SHW with cage control (KZST)



Detailed information on the cage control is listed under Chapter 7.9.

Compatible with:
Linear guideway type M/V

Design:
Needles fixed in plastic. Thus smaller displacement forces and smoother running.

Installation method:
For normal application and certain overrunning cage applications

Material:
Stainless steel and plastic PA 12 GF 30 %

Type	Size	Dw	Lw	e	t	w	C_{100} per needle in N	C_{50} pro Nadel in N	Compatible with linear guideways type	max. length in mm
SHW	15	2	6.8	14	4	approx. 2.9	750	922.50	M/V 4020 and M/V 5025	1'500
	20	2.5	9.8	19	4.75	approx. 3.4	1'375	1691.25	M/V 6035	1'500
	25	3	13.8	25	5.2	approx. 3.6	2'350	2890.50	M/V 7040	1'500
	30	3.5	17.8	30	6.1	approx. 4.3	3'600	4428.00	M/V 8050	1'500

Accessories type M/V

Needle cage type HW

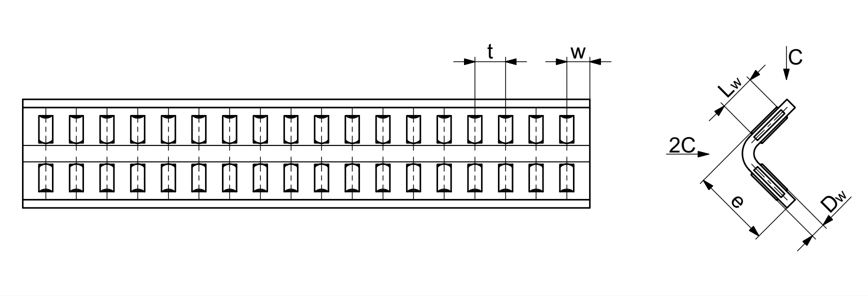
Compatible with:
Linear guideway type M/V

Design:
Needles fixed

Installation method:
Specifically suitable as an overrunning cage

Material:
Standard
- Size HW 10 is made out of tool steel
- All other sizes in aluminium

Optional
- All cages are available in steel



Type	Size	Dw	L_w	e	t	w	C_{100} per needle in N	C_{50} per needle in N	Compatible with linear guideways type	max. length in mm
HW	10	2	4.8	10	4	approx. 3	530	651.90	M/V 3015	1'980
	15	2	6.8	14	4.5	approx. 3.5	750	922.50	M/V 4020 and M/V 5025	1'950
	16	2	8.8	16	3.8	approx. 2.8	970	1193.10	M/V 5025	1'990
	20	2.5	9.8	20	5.5	approx. 4	1'375	1691.25	M/V 6035	1'970
	25	3	13.8	25	6	approx. 4.5	2'350	2890.50	M/V 7040	1'940
	30	3.5	17.8	30	7	approx. 5	3'600	4428.00	M/V 8050	1'980

Needle cage type HW with cage control (KZST)

Detailed information on the cage control is listed under Chapter 7.9.

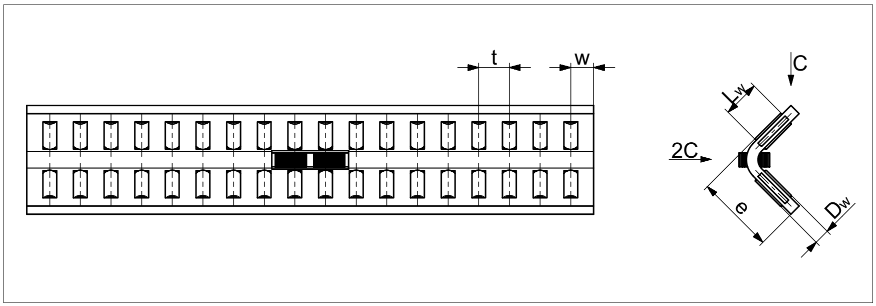
Compatible with:
Linear guideway type M/V

Design:
Needles fixed

Installation method:
Specifically suitable as an overrunning cage

Material:
Standard
- Size HW 10 is made out of tool steel
- All other sizes in aluminium

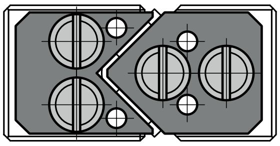
Optional
- All cages are available in steel

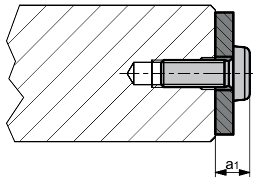


Type	Size	Dw	L_w	e	t	w	C_{100} per needle in N	C_{50} per needle in N	Compatible with linear guideways type	max. length in mm
HW	10	2	4.8	10	4	approx. 3	530	651.90	M/V 3015	1'980
	15	2	6.8	14	4.5	approx. 3.5	750	922.50	M/V 4020 and M/V 5025	1'950
	16	2	8.8	16	3.8	approx. 2.8	970	1193.10	M/V 5025	1'990
	20	2.5	9.8	20	5.5	approx. 4	1'375	1691.25	M/V 6035	1'970
	25	3	13.8	25	6	approx. 4.5	2'350	2890.50	M/V 7040	1'940
	30	3.5	17.8	30	7	approx. 5	3'600	4428.00	M/V 8050	1'980

Accessories type M/V

End piece type EM/EV





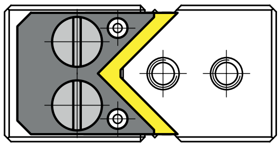
Compatible with:
For all M/V rail sizes

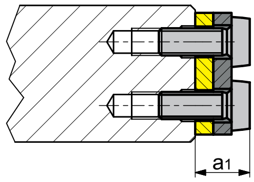
Installation method:
No restrictions

Scope of supply:
Including fastening screws

Size	3'015	4'020	5'025	6'035	7'040	8'050
a_1	5	8	9	9	9	9

End piece type EAM





Special feature:
With wipers made of plastic

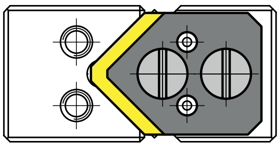
Compatible with:
For all M/V rail sizes

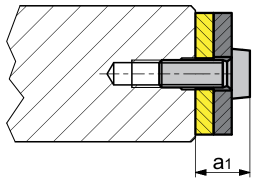
Installation method:
No restrictions

Scope of supply:
Including fastening screws

Size	3015	4020	5025	6035	7040	8050
a_1	7	10	11	11	11	11

End piece type EAV





Special feature:
With wipers made of plastic

Compatible with:
For all M/V rail sizes

Installation method:
No restrictions

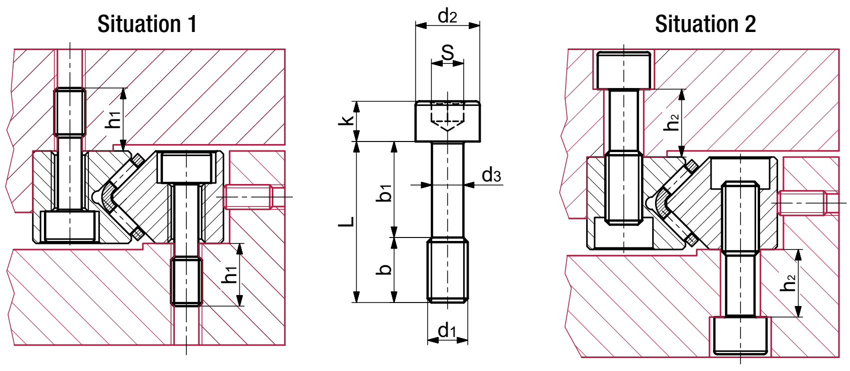
Scope of supply:
Including fastening screws

Size	3015	4020	5025	6035	7040	8050
a_1	7	10	11	11	11	11

Accessories for type M/V

Fastening screws with thin shaft type GD 3015 to GD 8050

Special feature:
To compensate for differences in hole pitches

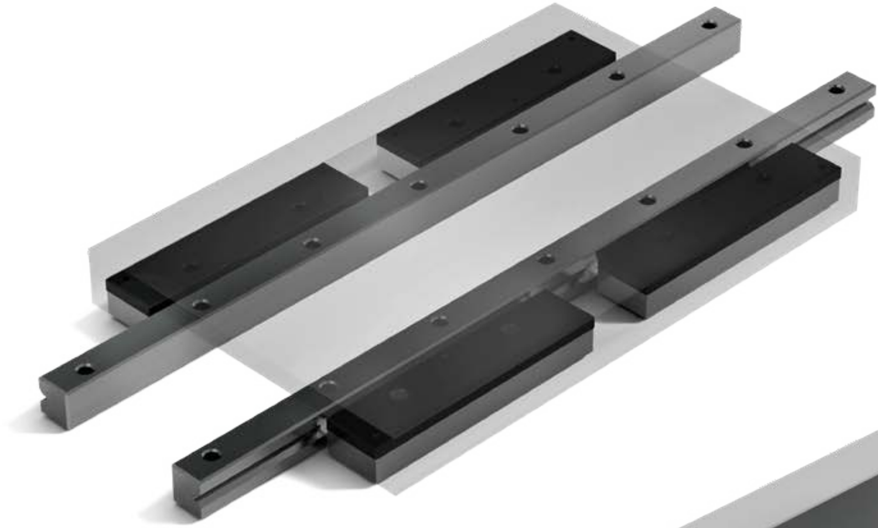


Type	Size	L	b	b_1	d_1	d_2	d_3	k	s	Max. tightening torque in Ncm*	Compatible with guideways of size (Situation 1)	Compatible with guideways of size (Situation 1)**
GD	3015	25	13	12	M4	7	3	4	3	221	M/V3015	M/V3015
	4020	30	12	18	M6	8.5	4.6	6	5	762	M/V4020	M/V4020
	5025	35	13	22	M6	8.5	4.6	6	5	762	M/V5025	M/V5025
	6035	45	17	28	M8	11.3	6.25	8	6	1838	M/V6035	M/V6035
	7040	50	19	31	M10	13.9	7.9	10	8	3674	M/V7040	M/V7040
	8050	60	21	39	M12	15.8	9.6	12	10	6579	M/V8050	M/V8050

* Tightening torques apply for materials with a tensile strength of > 360N/mm²
** Situation 2 applies only for hole variant G (see chapter 7.10)

6 Recirculating unit

Product specifications



Application with recirculating units and linear guideways of type R

Application with recirculating units and a linear guideway of type RD

Recirculating units support high-precision, rigid and compact structures with unlimited travel. They are used as standard with linear guideways of type R or RD.

The SCHNEEBERGER product range includes recirculating units in different versions and for different load capacities; with rollers or balls, with damping elements or for minimal lubrication .

The range is modular in structure and depending on the type includes sizes from 1 to 12.

6 Recirculating unit

6.1 Type SK and SKD

Type SK

Type SKD

The type SK recirculating unit is equipped with balls and is suitable for small to medium loads.

This recirculating unit is used combined with SCHNEEBERGER linear guideways of type R and/or RD. The SK units can be used in space saving designs that have equal loading in all directions.

Sizes 6 and 9 (size 12 on request) can additionally be equipped with damping elements (type designation SKD). These provide improved smoothness with slightly reduced load carrying capacity.

Benchmark data

Supporting structure
- Hardened and ground with high precision

Materials
- Supporting structure made of through hardened tool steel, hardness 58 - 62 HRC
- Rolling element made of through hardened roller bearing steel, hardness 58 - 64 HRC
- Transmission part in sizes 1, 2, 9 and 12 made of anodized aluminium
- Transmission part in sizes 3 and 6t depending on the length made of plastic or aluminium
- Non-corrosive version on request
- Damping elements for SKD made of plastic
- Wipers made of plastic

Wipers
- From size 3 interchangeable track wipers are made from plastic as standard fitted

Speed
- 2 m/s

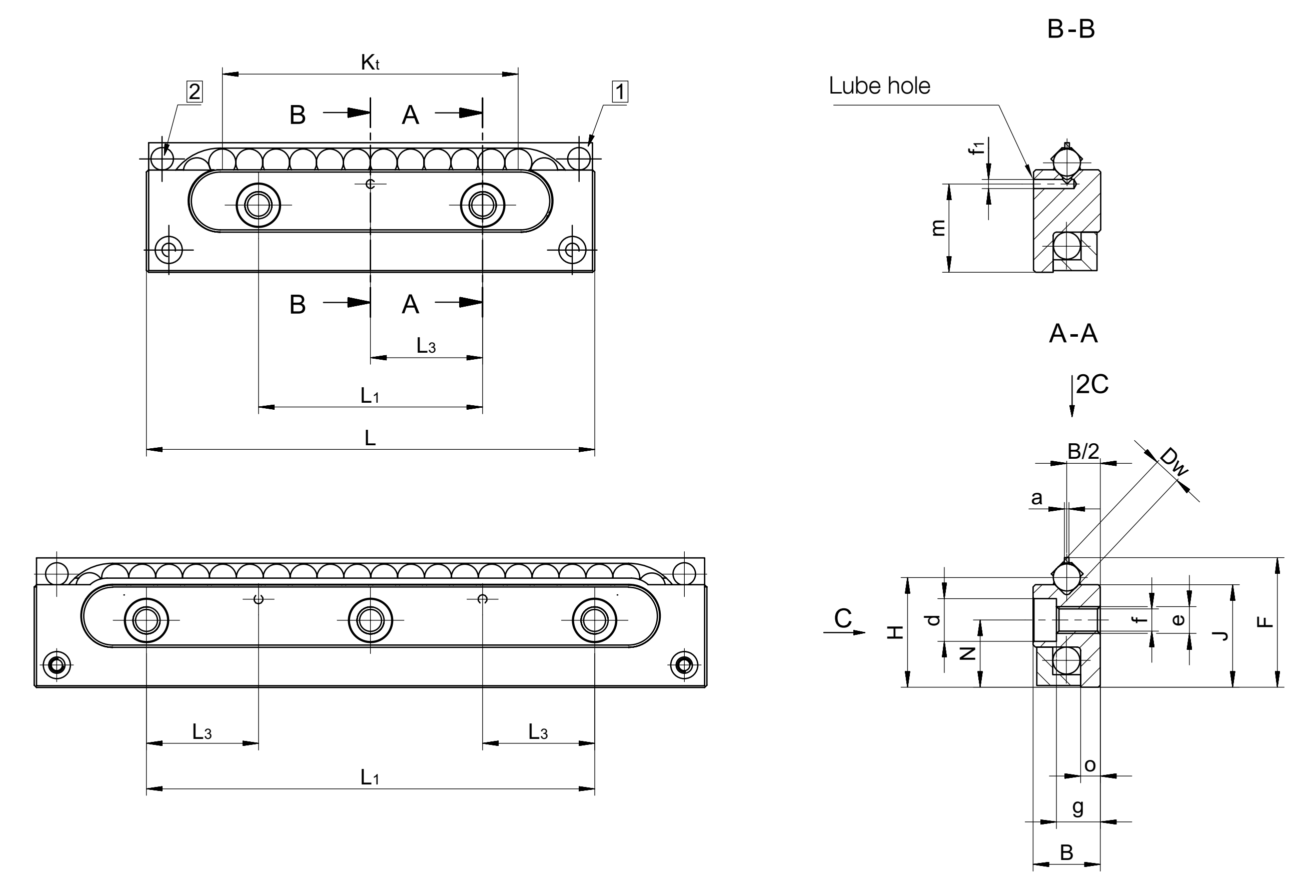
Acceleration
- 50 m/s^2

Operating temperatures
- -40° C to +80° C

Same installation with the following recirculating units
- SKC and SR

Can be combined with the following products
- Linear guideway type R and RD

Dimensions and load capacities type SK and SKD



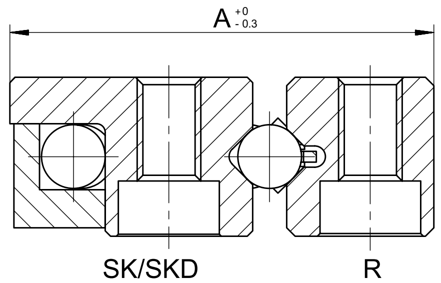
[1] Retaining web may not be used as a stop

[2] Wiper from size SK 3-075

Type and size		Weight in g	B	Dw	F	H	J	K_t	L	L_1	L_3	N	a	d	e	f	f_1	g	m	o	C in N SK	C in N SKD	Options (see chapter 8)
SK 1-022		5	4	1.5	8.4	7.25	6.9	9	22	10	-	4.8	0.3	3	M2	1.65	-	2.6	-	1.2	63		GP
SK 2-032		10	6	2	11	9.5	9	16	32	15	-	6	0.3	4.4	M3	2.55	-	4	-	1.9	135		GP
SK 3-075		45	8	3	16.9	14.5	13.8	48	75	25	12.5	9	0.5	6	M4	3.3	1.5	4.9	11.5	2.4	425		GP
SK 6-100	**SKD 6-100**	200	15	6	28.9	24.5	22.9	60	100	50	25	15	1	9.5	M6	5.2	2	9.8	19.7	4.4	715	650	GP
SK 6-150	**SKD 6-150**	300						102	150	2 x 50											1'170	1'100	
SK 9-150	**SKD 9-150**	670	22	9	45.1	39	36.7	90	150	100	50	26	1.5	10.5	M8	6.8	3	15.8	32.4	6.3	1'650	1'500	GP
SK 9-200	**SKD 9-200**	940						144	200												2'550	2'400	
SK 12-200[1]	**SKD 12-200**[1]	1'470	28	12	57.1	49	45.9	120	200	100	50	32	2	13.5	M10	8.5	3	19.8	40.2	7.7	2'860	2'600	GP

[1] SK 12 and SKD 12 are only available upon request

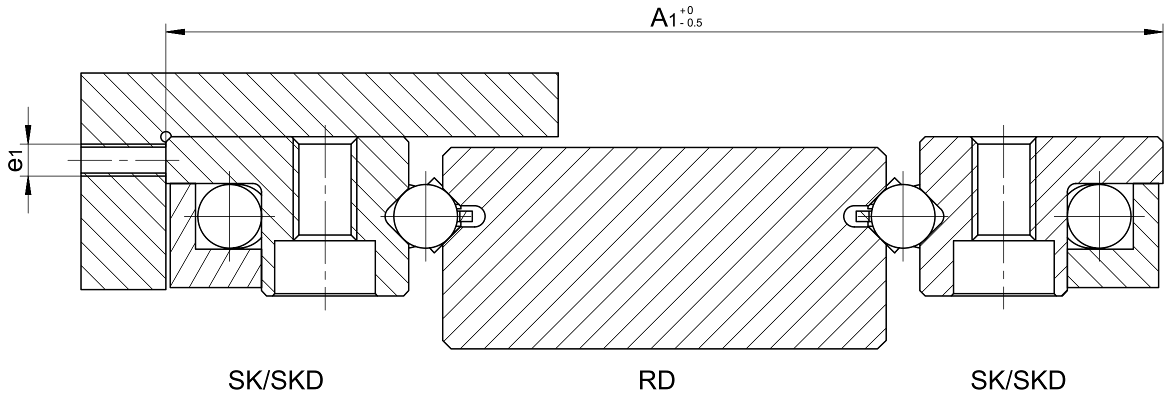
Installed dimensions and permissible torque for type SK and SKD

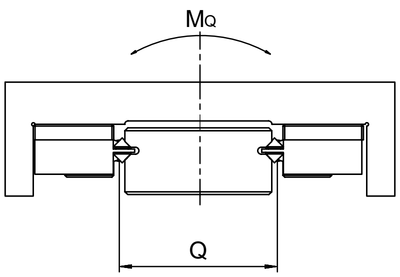


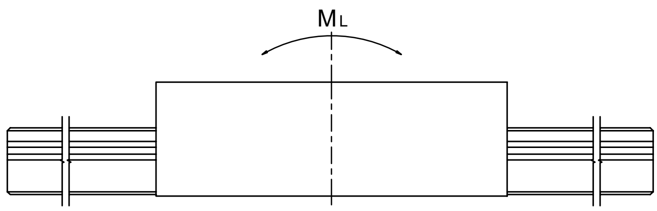
Installed dimensions for type SK and SKD

Type	Size	A	A_1	e_1
SK	1-022	11.5	28	M1.6
	2-032	15.5	37	M2.5
	3-075	23.5	57	M3
SK and SKD	6-100	40	94	M5
	6-150	40	94	M5
	9-150	61	150	M6
	9-200	61	150	M6
SK and SKD[1)]	12-200	78	175	M8

[1)] SK 12 und SKD 12 sind nur auf Anfrage erhältlich

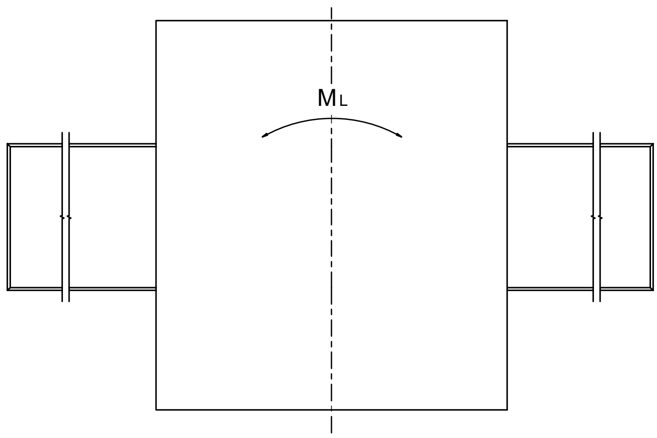






Permissible torques for type SK and SKD

Type	Size	Q	M_L in Nm		M_Q in Nm	
			SK	SKD	SK	SKD
SK	1-023	13.5	0.4		0.8	
	2-033	18.0	1.4		2.4	
	3-076	28.0	7.2		12.0	
SK and SKD	6-100	45.0	23.0	23.0	32.0	29.0
	6-150		40.0	40.0	53.0	50.0
	9-150	72.0	81.0	81.0	119.0	108.0
	9-200		130.0	130.0	184.0	173.0
SK and SKD[1)]	12-200	77.0	187.0	187.0	220.0	200.0



[1)] SK 12 und SKD 12 sind nur auf Anfrage erhältlich

6 Recirculating unit

6.2 Type SKC

The recirculating unit type SKC was developed for minimal lubrication, vacuum and clean room applications. It is made out of DURALLOY® coated steel and has ceramic balls, which are separated from one another by balls made out of TEFLON®.

This recirculating unit is used combined with SCHNEEBERGER linear guideways of type R and/or RD. The SKC units can be used in space saving designs that have equal loading in all directions. It is suitable for small to medium loads.

Benchmark data

Supporting structure
- Hardened and ground and coated with high precision

Materials
- Supporting structure made of stainless steel 1.4034, DURALLOY® coated, hardness min. 54 HRC
- Transmission part made out of stainless steel 1.4034
- Rolling element made of ceramic
  (balls made of TEFLON® between the ceramic balls are responsible for minimal friction)

Speed
- 2 m/s

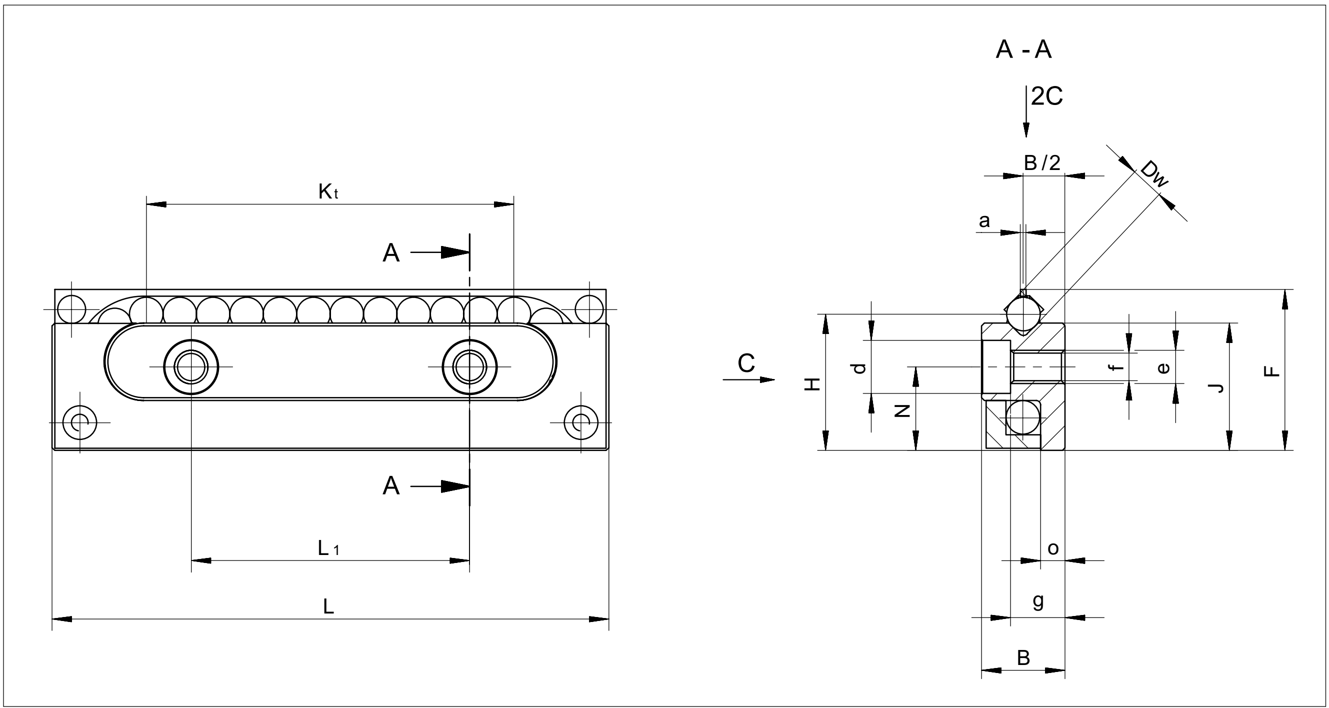
Acceleration
- 50 m/s^2

Operating temperatures
- -150° C to +200° C

Same installation with the following recirculating units
- SK, SKD and SR

Can be combined with the following products
- Linear guideway type R and RD

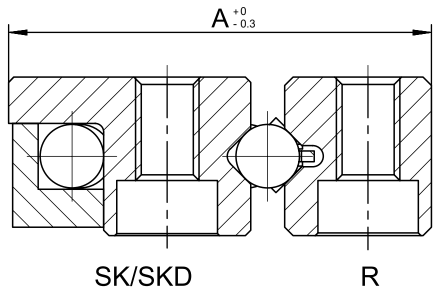
Dimensions and load capacities of type SKC



Type and size	Weight in g	B	Dw	F	H	J	K_t	L	L_1	N	a	d	e	f	g	o	C* in N	Options (see chapter 8)
SKC 3-075	44	8	3	16.9	14.5	13.8	48	75	25	9	0.5	6	M4	3.3	4.9	2.4	75	GP
SKC 6-100	212	15	6	28.9	24.5	22.9	60	100	50	15	1	9.5	M6	5.2	9.8	4.4	125	GP

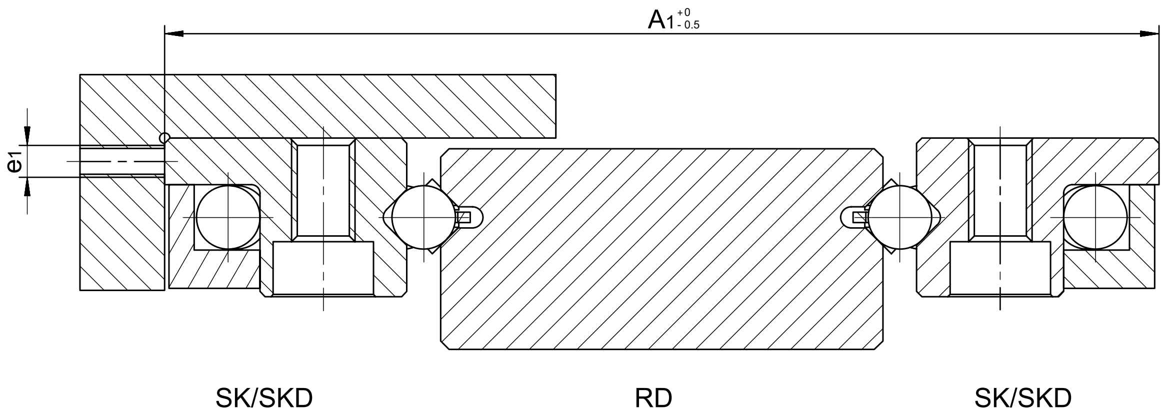
* Loading capacity for minimal lubrication

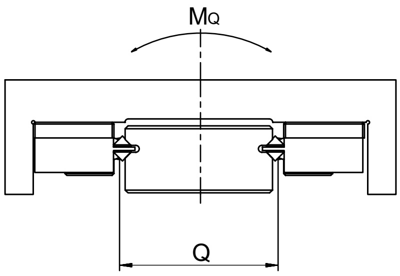
Installed dimensions and permissible torques for type SKC

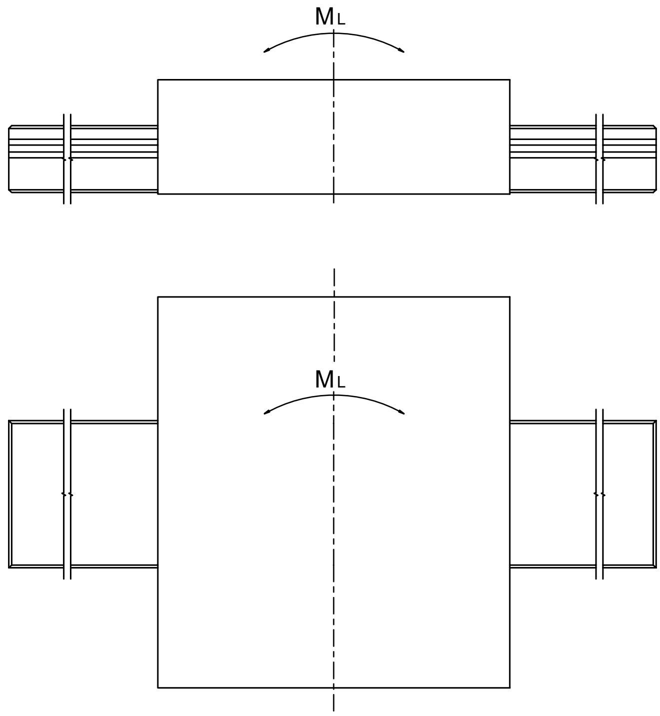


Installed dimensions for type SKC

Type	Size	A	A_1	e_1
SKC	3-075	23.5	57	M3
SKC	6-100	40	94	M5







Permissible torques for type SKC

Type	Size	Q	M_L in Nm	M_Q in Nm
SKC	3-075	28.0	0.9	2.1
SKC	6-100	45.0	3.0	5.6

6.3 Type SR

The SR recirculating units has cross rollers and is suitable for medium to high loads.

This recirculating unit is used combined with SCHNEEBERGER linear guideways of type R and/or RD. In this way space-saving designs can be created that can be equally loaded in all directions.

Benchmark data

Supporting structure
- Hardened and ground with high precision

Materials
- Supporting structure made of through hardened tool steel, hardness 58 – 62 HRC
- Rolling element made of through hardened roller bearing steel, hardness 58 – 64 HRC
- Transmission part depending on the length made of plastic or anodized aluminium
- Stainless steel on request
- From size 3 the rollers are laid in plastic shoes

Speed
- 2 m/s

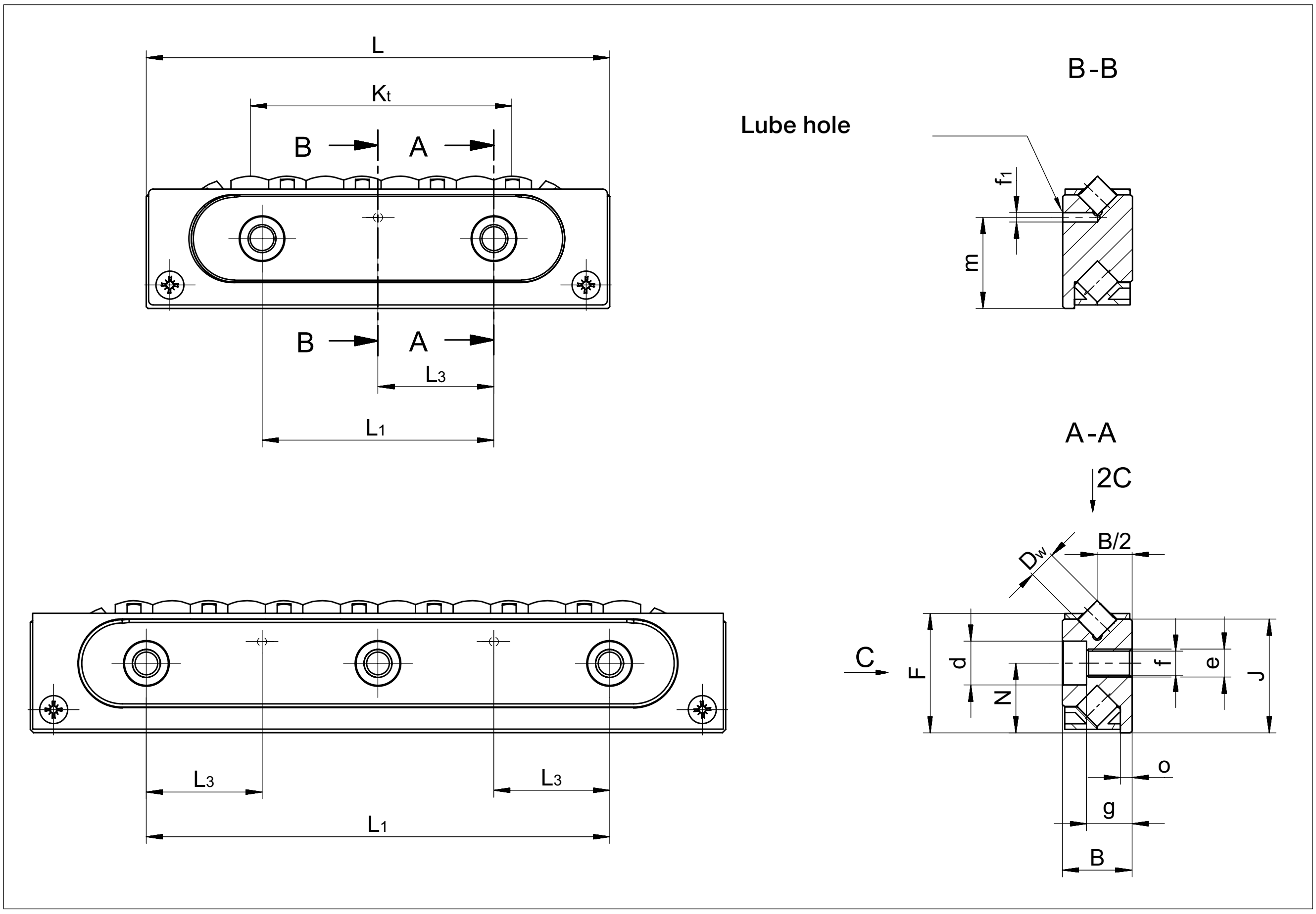
Acceleration
- 50 m/s^2

Operating temperatures
- -40° C to +80° C

Same installation with the following recirculating units
- SK, SKD and SKC

Can be combined with the following products
- Linear guideway type R and RD

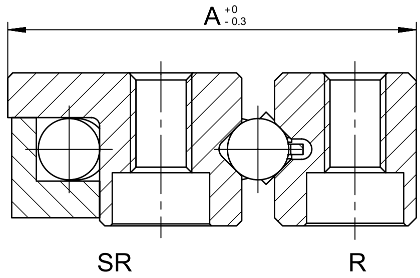
Dimensions and load capacities of type SR



Type and size	Weight in g	B	Dw	F	J	K_t	L	L_1	L_3	N	d	e	f	f_1	g	m	o	C in N	Options (see chapter 8)
SR 2-032	10	6	2	9.8	9.5	16	32	15	-	6	4.4	M3	2.55	-	4	-	1	380	GP
SR 3-075	50	8	3	15	14.5	46	75	25	12.5	9	6	M4	3.3	1.5	4.9	11.8	1.3	850	GP
SR 6-100	210	15	6	25.7	24.5	56	100	50	25	15	9.5	M6	5.2	2	9.8	19.7	2.5	2'150	GP
SR 6-150	310					105	150	50										3'750	
SR 9-150	750	22	9	40.5	39	92	150	100	50	26	10.5	M8	6.8	3	15.8	32.4	3.5	5'850	GP
SR 12-200[1]	1'580	28	12	51.5	49	112	200	100	50	32	13.5	M10	8.5	3	19.8	40.2	4	10'000	GP

[1] SR 12 sind nur auf Anfrage erhältlich

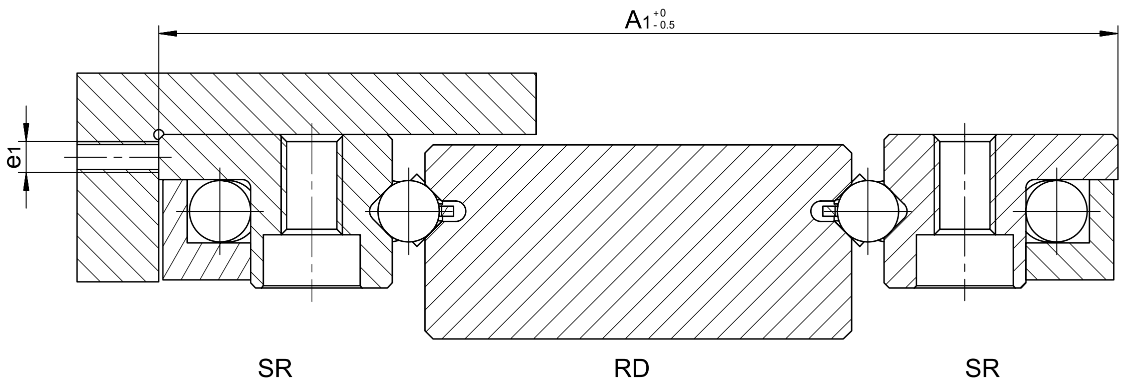
Installed dimensions and permissible torques for type SR

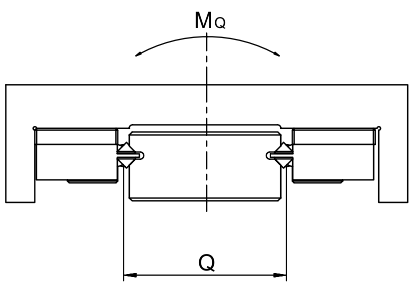


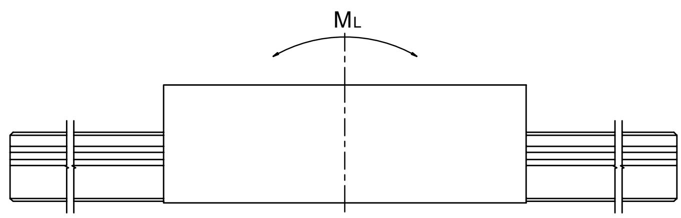
Installed dimensions for type SR

Type and size	A	A_1	e_1
SR 2-032	15.5	37	M2.5
SR 3-075	23.5	57	M3
SR 6-100	40	94	M5
SR 6-150	40	94	M5
SR 9-150	61	150	M6
SR 12-200[1]	78	175	M8

[1] SR 12 sind nur auf Anfrage erhältlich



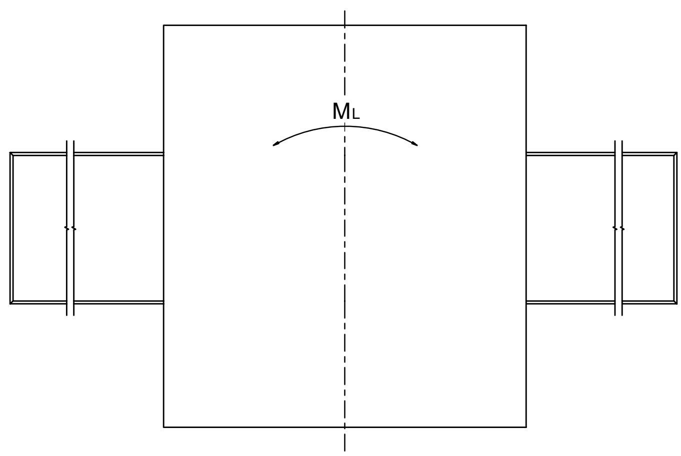




Torques for type SR

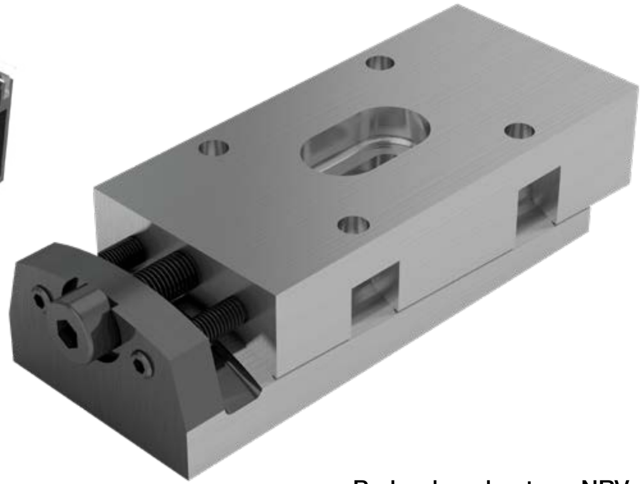
Type and size	Q	M_L in Nm	M_Q in Nm
SR 2-032	18.0	3.0	7.0
SR 3-075	28.0	12.0	24.0
SR 6-100	45.0	60.0	97.0
SR 6-150		112.0	169.0
SR 9-150	72.0	241.0	421.0
SR 12-200[1]	77.0	553.0	770.0

[1] SR 12 sind nur auf Anfrage erhältlich



6.4 Type NRT (with NRV)

Recirculating unit type NRT



Preload wedge type NRV

This roller recirculating unit is designed for medium to heavy loads. Solutions to demanding applications can be created using NRT, NRV, and suitable guideways.

Advantages/benefits of the NRT

- Two independent tracks, the small amount of roller play and the optimal ratio of roller length and roller diameter are responsible for minimal lateral forces.
- The large number of rollers and the optimised roller run-ins are responsible for minimal travel pulsation and a low coefficient of rolling friction
- High degree of rigidity thanks to three-point support on the rear
- Protected roller return
- Double-lipped wipers on each side
- Can also be supplied matched as an option, sorted within 5µm

Advantages/benefits of the preload wedge NRV

This preload wedge is used for setting preload. The NRV with its concave and convex supporting surfaces is also able to even out minor angular errors and deformations in the connecting structure.

Benchmark data

Supporting structure
- Hardened and ground with high precision

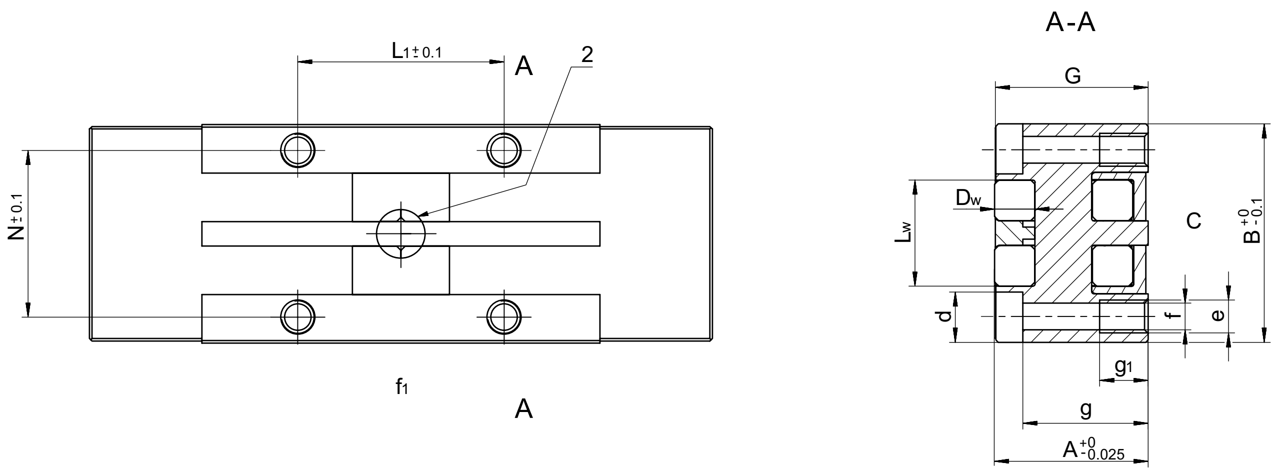
Materials
- Supporting structure made of through hardened tool steel, hardness 58 – 62 HRC
- Rolling element made of through hardened roller bearing steel, hardness 58 – 64 HRC
- Transmission parts and wipers made of plastic

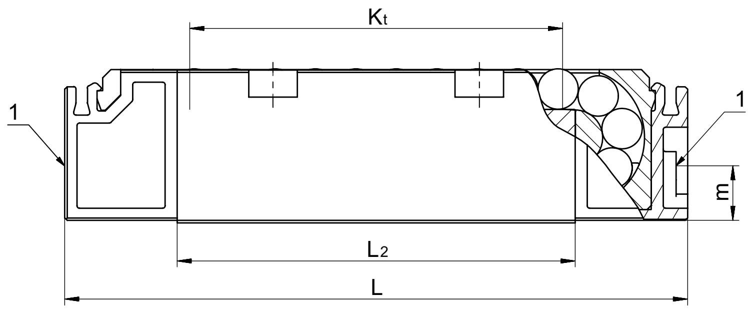
Speed
- 1 m/s

Acceleration
- 50 m/s²

Operating temperatures
- -40° C to +80° C

Dimensions and load capacities of type NRT



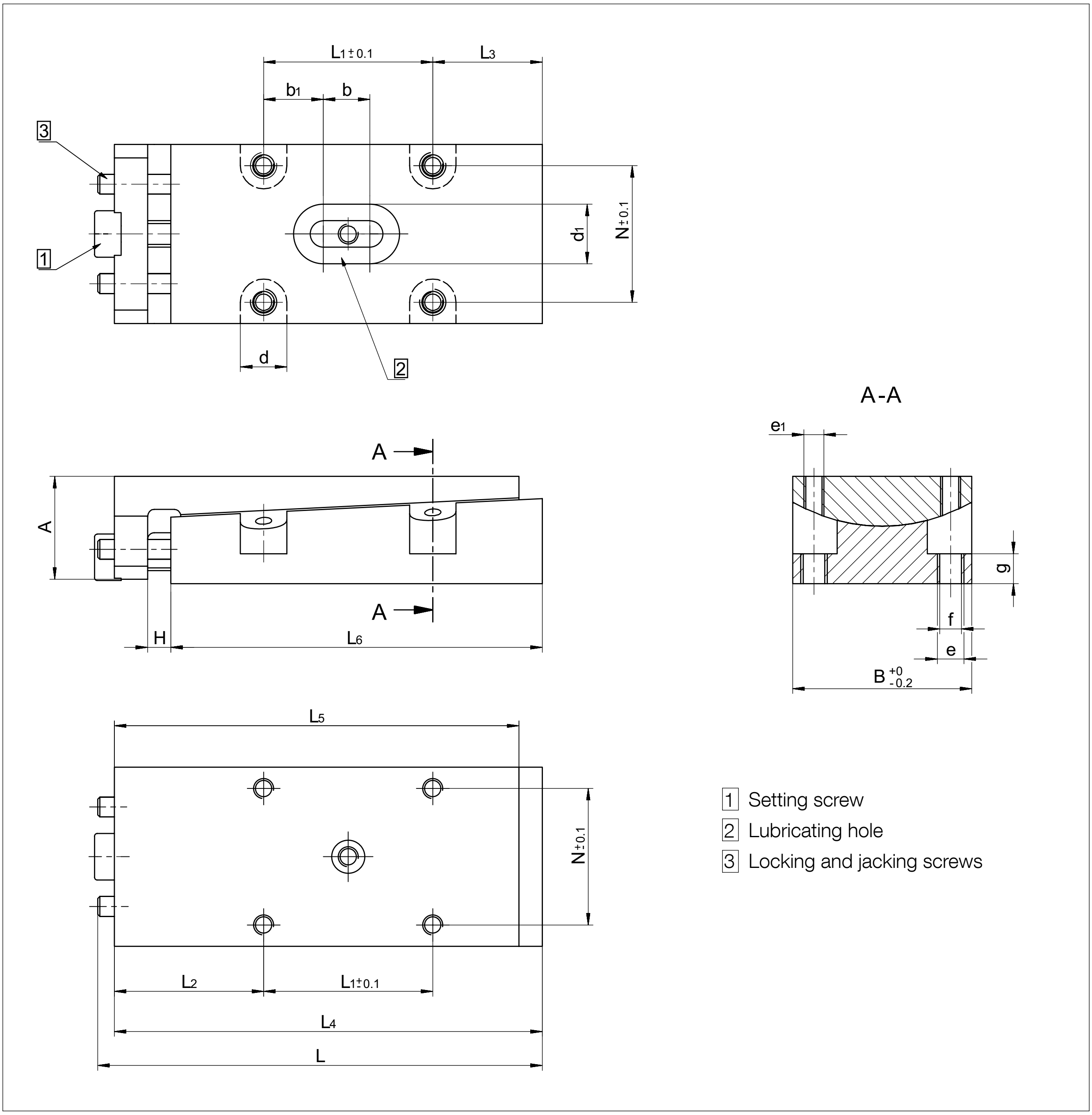


1 lubricating nipple Ø4 type D1a on both sides
2 Lubricating hole

Recirculating unit type NRT

Type and size	Weight in g	A	B	Dw	G	K_t	L	L_1	L_2	L_w	N	d	e	f	f_1	g	g_1	m	C in N	Options (see chapter 8)
NRT 19077	185	19	27	5	18.85	45	77	25.5	49.2	13	20.6	6	M4	3.3	6	15.5	6	5.3	43'000	GP ZS
NRT 26111	570	26	40	7	25.85	70	111	44	75.6	19	30	8	M6	5	9	20	10	10.3	98'000	GP ZS
NRT 26132	721					91	132	68	96.6							20.6			120'000	GP ZS
NRT 38144	1'390	38	52	10	37.8	90	144	51	96.8	26	41	11	M8	6.8	11	29	14	14.5	181'000	GP ZS

Dimensions and load capacities of type NRV



Preload wedge NRV

Type and size	Weight in g	A	B	H max.	L max.	L_1	L_2	L_3	L_4 max.	L_5	L_6	N	b	b_1	d	d_1	e	e_1	f	g
NRV 19077	195	16	27	7	72	25.5	22.5	16.5	68	61	56	20.6	7	9	7	9	M4	M3	3.3	4.5
NRV 26111	670	25	40	8	105	44	29	21	98	90	83	30	9	17.5	8	11	M6	M4	5	8
NRV 26132	837				126	68	27.5	19.5	119	111	104			29.5						
NRV 38144	1'300	30	52	8	130	51	37.5	28.5	121	113	105	41	10	20.5	11	14	M8	M6	6.8	8

7 Options for linear guideways

7.1 Quality classes (SQ and SSQ)

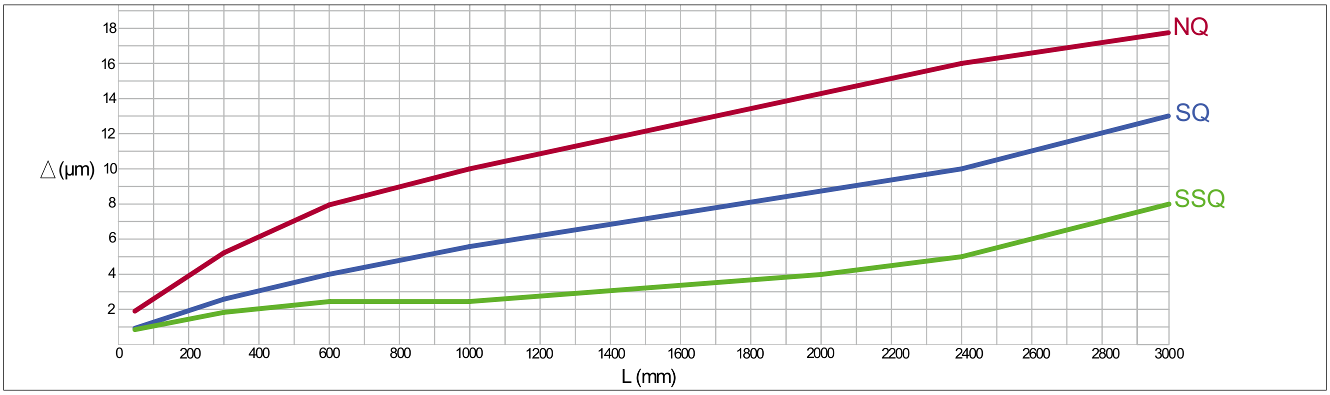
The run and positioning accuracy of an application depends directly on the geometric precision of the guideway, its careful alignment, as well as the precision and stiffness of the surrounding construction.

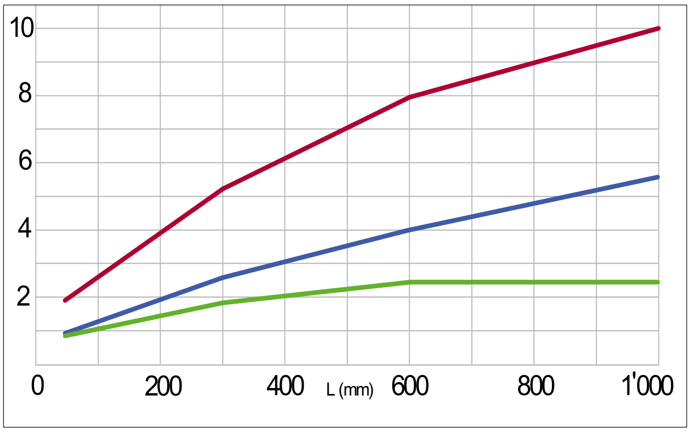
Depending upon the application different levels of accuracy are required. SCHNEEBERGER linear guideways are available in three quality classes to address a variety of applications:

NQ*	Normal quality	Represents normal requirements in mechanical engineering
SQ	Special quality	In case of very stringent requirements
SSQ	Super special quality	In case of the most stringent requirements

Note:
*NQ represents standard quality and is not subsequently listed as an order code

The corresponding tolerance values (Δ) for parallelism of the running surfaces in relation to the reference and locating surfaces can be seen in the diagram below.





In terms of the quality classes SQ and SSQ the following limitations technically exist:
- Max. lengths according to the table „Dimensions and load capacities“ of the respective product.
- Coatings (see chapter 7.6 and 7.7).

7.2 Guideways made of corrosion-resistant steel (RF)

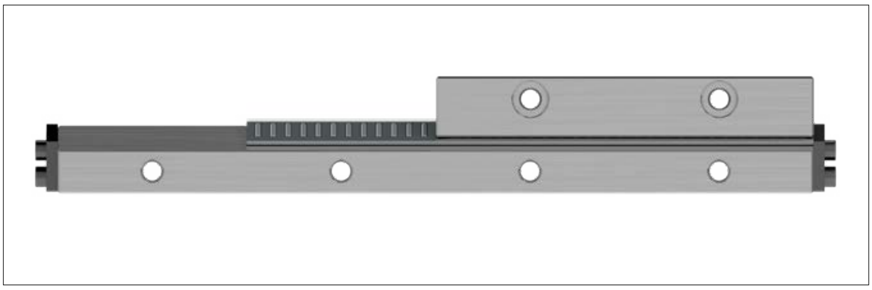
For certain applications such as, for example, medical technology, food industry or in a vacuum, the guide rails can be made of corrosion-resistant steel.

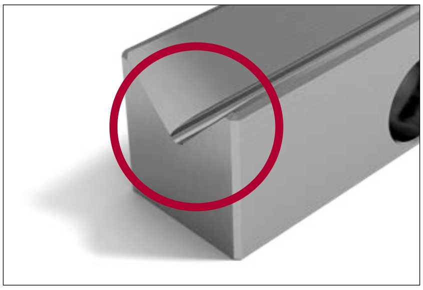
Notes:
- The max. rail length in normal quality as well as in options SQ and SSQ is limited (see „dimensions and load capacities“ of the respective product).
- The hardness of the steel reduces compared with tool steel to min. 54 HRC, which should be taken into account in the food calculation.

7 Options for linear guideways

7.3 Run-ins rounded (EG)

Overrunning cages are expedient to used if a short table is to be moved on a long guideway track. As a result the upper part is at any time supported over its entire length, which has a positive effect on the load carrying capacity and rigidity.





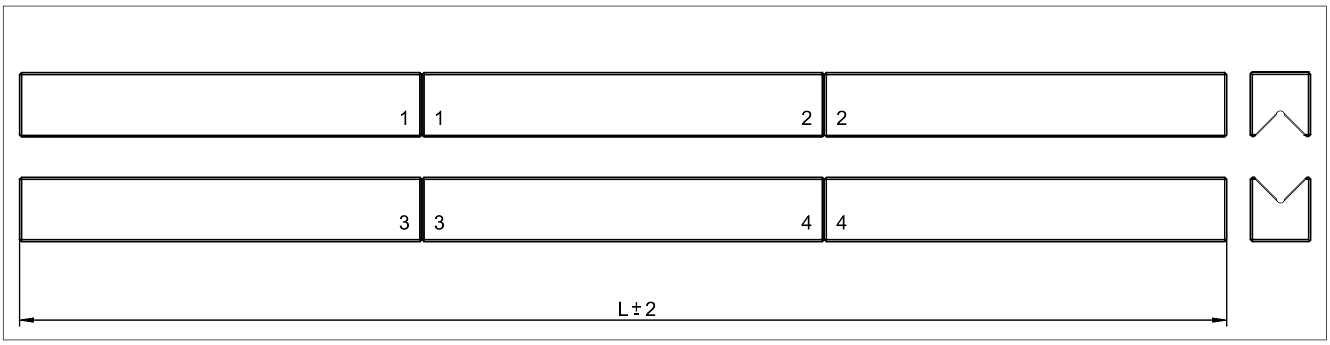
So that the cage run-in causes as little pulsation as possible, the short rails are provided with rounded run-ins. The run-ins are ground following manufacture of the guideway track.

Note:
On rare occasions (e.g. under very high preload), in spite of rounded run-ins the pulsation of the overrunning cage can have a disruptive effect on the application. This phenomenon can be largely eliminated by taking appropriate measures (on request).

7.4 Multi-part linear guideways (ZG)

Is the desired overall length of the guideway is greater than the maximum length listed in this catalogue, individual rails can be ground together. The offset between the individual guideway tracks for this is max. 0.002 mm. The length tolerance L is within +/- 2 mm.

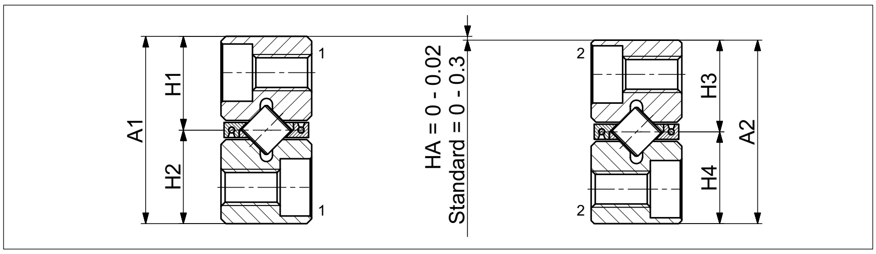
During installation it is important to pay attention to the numbering at the butt joint.



7.5 Height-matched guideways (HA and EHA)

Height-matched guideways (HA)

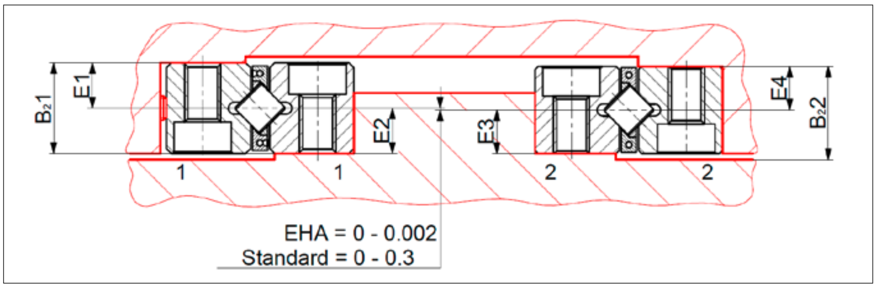
The height difference between two linear guideway pairs (A1 and A2) is 0 mm to 0.3 mm as standard. This difference can be too large depending on the application. For height-matched guideways, the H dimensions of the linear guideways (H1 to H3 and H2 to H4) are measured and sorted so that the height difference of both linear guideway pairs (A1 and A2) can be reduced to a maximum of 0 mm to 0.02 mm. In addition, the guideways are numbered the same in pairs. This numbering is consecutive for multiple guideway pairs.



E dimension of height-matched guideways (EHA)

The width difference between two linear guideways (B21 to B22) is 0 mm to 0.02 mm as standard. This difference can be too large depending on the application. For the E dimensions of height-matched guideways, the E dimensions of the linear guideways (E1 to E3 and E2 to E4) are measured and sorted so that the width difference of both linear guideway pairs (B21 and B22) can be reduced to a maximum of 0 mm to 0.002 mm. In addition, the guideways are numbered the same in pairs. This numbering is consecutive for multiple guideway pairs.

Note: EHA option only available up to size 6



7.6 DURALLOY® coating (DU)

For applications for which corrosion protection and/or increased wear resistance of the surfaces is required, coating the guideways with DURALLOY® is recommended.

Technical information

- Max. rail length	3'000 mm
- Hardness	HRC 64 - 74
- Coating thickness	2.5 – 4.0 µm
- Structure	"Pearlescent" (see figure)
- Vacuum-compatible	10^{-7} mbar

The advantages of DURALLOY®

- Increased wear resistance
- Corrosion protection
- The pearl structure acts as a lubricant reservoir
- Good emergency running characteristics
- Protection from abrasive corrosion
- High degree of chemical resistance
- Cleanroom compatible
- FDA approved

Notes:

- The ZG special versions (multi-part linear guideway) and the maximum quality grade SSQ are not possible.
- Special quality SQ only on requeste

7.7 DryRunner coating (DR and DRC1)

Without lubrication, the running surfaces of linear guideways are completely destroyed after only 10,000 revolutions.

A guideway coated with DryRunner allows for more than 100 million revolutions without lubrication and thus a service life lubrication that is 10,000 times longer. In a vacuum, an unlubricated guideway coated with DryRunner allows more than 50 million revolutions.

To achieve outstanding running performance, we recommend the DryRunner coating in combination with minimal lubrication using a common lubricant.

Technical information

Area of use	Air	Vacuum (bis 10^{-7} mbar)
Order code	DR	DRC1
Film thickness	1.5 - 3.0 µm	1.0 – 2.0 µm
Operating temperature	-40°C - 80°C (up to 120 °C at short intervals)	-40°C - 80°C
Film Hardness	8-12 HIT [GPa]	12-15 HIT [GPa]
Max. length of the guideway	900 mm	380 mm

- The coating is only applied to the running surfaces. From a production standpoint, it is possible to coat other exterior surfaces but not the supporting and locating surface of the guideway.
- DryRunner does not provide any protection against corrosion. If corrosion-resistant guideways are required, the guideway must be ordered in a rust-resistant material (RF) or with a Duralloy coating (DU).

The advantages of DryRunner
- Good emergency running properties insufficient lubrication
- Suitable for applications in air or vacuum
- Minimal wear due to abrasion
- High chemical resistance

Notes
- DryRunner permits operation with minimal lubrication.
- We recommend using the FORMULA-S cage control (KS) (see section 7.8).
- The special versions of the multi-part linear guideway ZG and the quality class SSQ are not possible. Quality class SQ on request (see section 7.4 and 7.1).

7.8 Cage control FORMULA-S (KS)

In every linear guideway the cage can be shifted from the centre along the longitudinal axis. Cage creep reduces the optimal load distribution and requires a correct stroke to return the cage to a centered position. the correction stroke requires a large expense of energy.

The causes of cage creep

- High accelerations and speeds
- Vertical installation of the guideway
- Uneven load distribution
- Protruding cage
- Different heat expansion coefficients
- Design and installation (lacking rigidity and/or accuracy of the connecting structure)

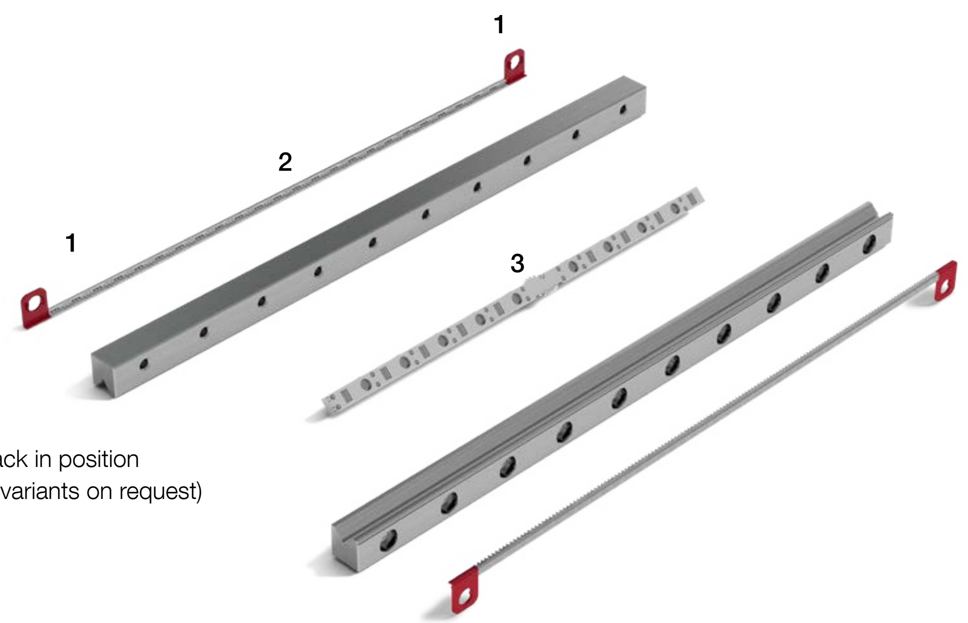
The benefits of FORMULA-S

- No cage slipping and thus consistent load conditions
- Avoids correction strokes
- No force required for cage reset
- Accelerations up to 300 m/s^2 (30 g)
- speed 1 m/s
- Easy to install and/or uninstall
- Extended service life
- Vacuum-compatible up to 10^{-7} mbar

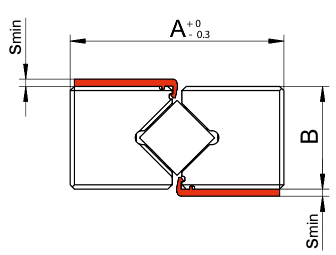
Suitable for the following guideways

- RN 3, RN 4 and RN 6
- RNG 4, RNG 6 and RNG 9

FORMULA-S meets the requirements fully in respect of productivity and cost-effectiveness. It is very robust and consists of only a few components.



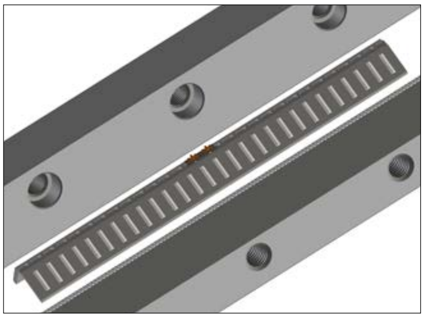
1 Clips hold the gear rack in position (alternative fastening variants on request)
2 Rack
3 Cage with pinion



Connecting structure

In the case of the connecting structure, the thickness s_{min} should be taken into account. The remaining dimensions correspond to the guideways RN and RNG (see chapter 5, dimensions and load capacities).

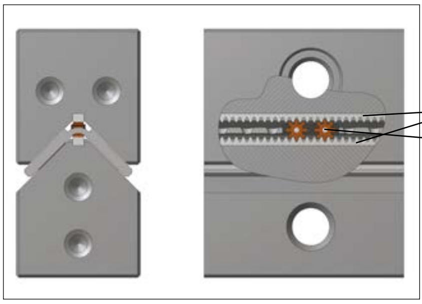
7.9 Cage control for N/O and M/V guideways (KZST)



The needle guideways of type N/O and M/V can be fitted with a cage control which ensures that process security is significantly increased. The causes and effects of cage creep are set out in chapter 7.8.

The benefits and advantages

- Perfect load distribution
- Avoids correction strokes
- No force required for cage reset
- Accelerations up to 200 m/s² (20 g)
- Max. speed 1 m/s
- Extended service life

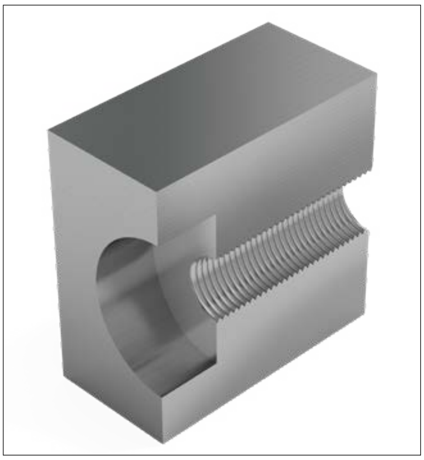


This type of cage control fully meets the requirements in terms of productivity and cost-effectiveness. It is very robust, has a simple structure and consists of only a few components:

A A gear rack made of tool steel per guide rail

B Two pinions made of tool steel per cage

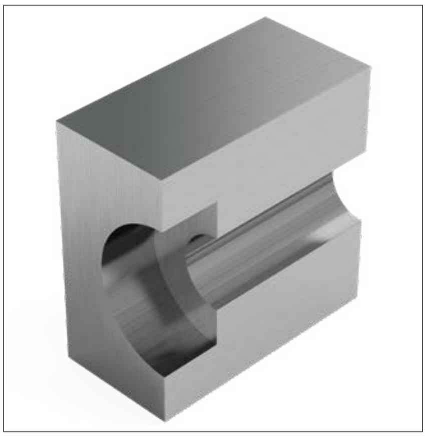
7.10 Fixing Hole Variants (V, G, or D)

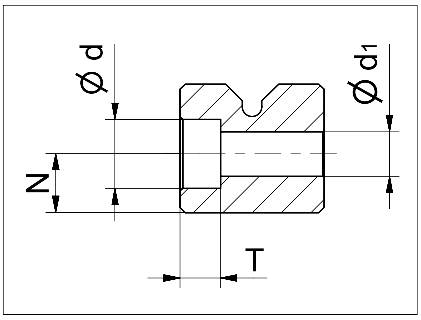


The SCHNEEBERGER standard

Most SCHNEEBERGER guideways have a counter bore with threading as standard. This is not suitable for the guideways of type M/V (variant V). This design supports the use of a tapped fixing hole as well as the through fixing hole. The dimensions can be seen in the respective product specifications (chapter 5).

Special versions type V (standard for linear guideway of type M/V)





Dimensions for R-guideways

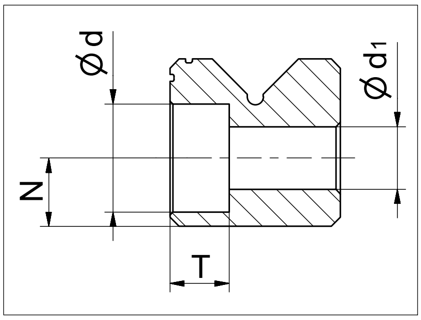
Type	N	Ø d	T	Ø d_1
R 1	1.8	3	1.4	1.65
R 2	2.5	4.4	2	2.55
R 3	3.5	6	3.2	3.5
R 6	6	9.5	5.2	5.5
R 9	9	10.5	6.2	6.5
R 12	12	13.5	8.2	8.5
R 15[1)]	14	16.5	10.2	10.5
R 18[1)]	18	18.5	12.2	12.5
R 24[1)]	24	22.5	14.2	14.5

Dimensions for RN-guideways

Type	N	Ø d	T	Ø d_1
RN 3	3.5	6	3.2	3.5
RN 4	4.5	8	4.1	4.5
RN 6	6	9.5	5.2	5.5
RN 9	9	10.5	6.2	6.5
RN 12[1)]	12	13.5	8.2	8.5
RN 15[1)]	14	16.5	10.2	10.5
RN 18[1)]	18	18.5	12.2	12.5
RN 24[1)]	24	22.5	14.2	14.5

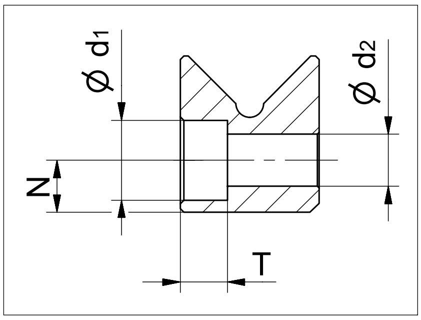
Dimensions for RNG-guideways

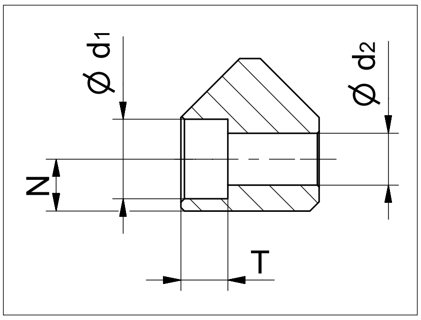
Type	N	Ø d	T	Ø d_1
RNG 4	3.5	6	3.2	3.5
RNG 6	5	7	3.2	4
RNG 9	6	8.5	4.2	4.8
RNG 12	8	12	6.2	7
RNG 15[1)]	10	15	8.2	9
RNG 20[1)]	12	18	11	10.5



Dimensions for RNG guideways with a cage control system (KS)

Type	N	Ø d	T	Ø d_1
RNG 4-KS	3.5	6	3.2	3.5
RNG 6-KS	5	7.8	3.5	3.8
RNG 9-KS	6	8.5	4.2	4.8



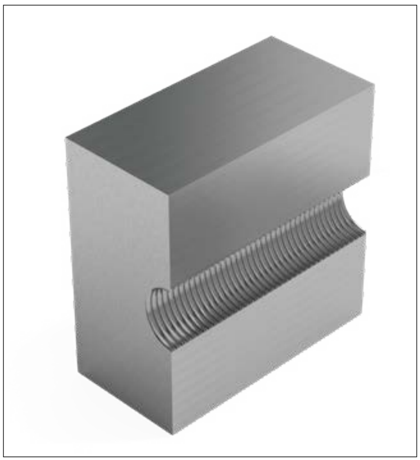


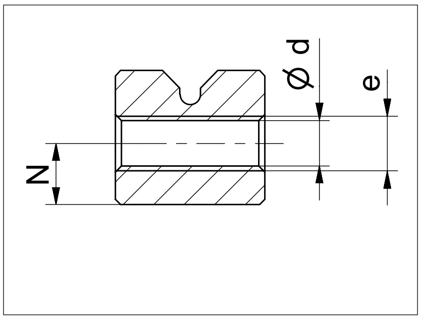
Dimensions for N/O-guideways

Type	N	Ø d_1	T	Ø d_2
N/O 62015	6	9.5	5.2	5.5
N/O 92025	9	10.5	6.2	6.8
N/O 2025	10	13.5	8.2	8.5
N/O 2535	12	16.5	10.2	10.5
N/O 3045	14	18.5	12.2	12.5
N/O 3555	14	18.5	12.2	12.5

[1)] R 15, R 18, R 24, RN 18, RN 24, RNG 15, and RNG 20 are only available upon request

Special versions type G





Dimensions for R-guideways

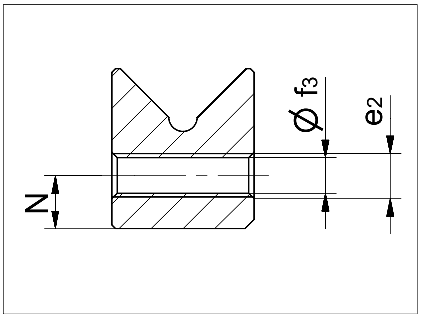
Type	N	e	Ø d
R 1	1.8	M2	1.65
R 2	2.5	M3	2.55
R 3	3.5	M4	3.3
R 6	6	M6	5.2
R 9	9	M8	6.8
R 12	12	M10	8.5
R 15[1)]	14	M12	10.5
R 18[1)]	18	M14	12.5
R 24[1)]	24	M16	14.5

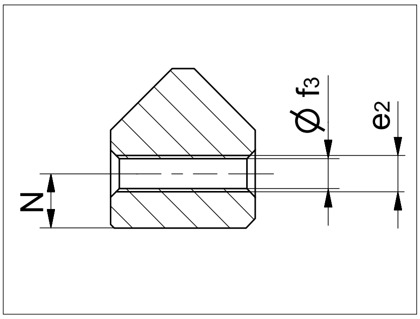
Dimensions for RN-guideways

Type	N	e	Ø d
RN 3	3.5	M4	3.3
RN 4	4.5	M5	4.3
RN 6	6	M6	5.2
RN 9	9	M8	6.8
RN 12	12	M10	8.5
RN 15[1)]	14	M12	10.5
RN 18[1)]	18	M14	12.5
RN 24[1)]	24	M16	14.5

Dimensions for RNG-guideways

Type	N	e	Ø d
RNG 4	3.5	M3	2.65
RNG 6	5	M4	3.3
RNG 9	6	M5	4.4
RNG 12	8	M8	6.8
RNG 15[1)]	10	M10	8.5
RNG 20[1)]	12	M12	10.5

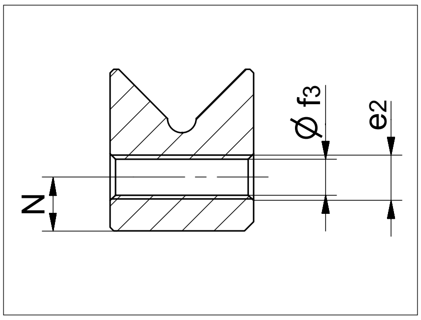


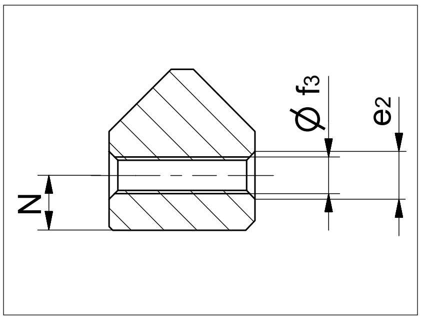


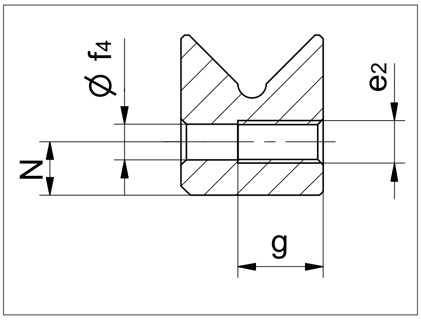
Dimensions for N/O-guideways

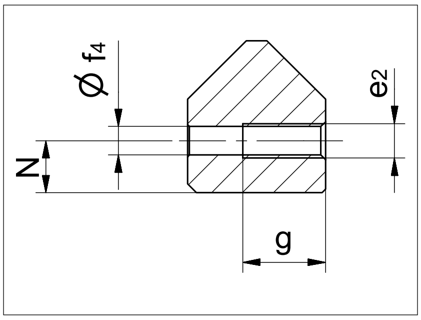
Type	N	e_2	Ø f_3
N/O 62015	6	M6	5.2
N/O 92025	9	M8	6.8
N/O 2025	10	M10	8.5
N/O 2535	12	M12	10.5
N/O 3045	14	M14	12.5
N/O 3555	14	M14	12.5

1) R 15, R 18, R 24, RN 18, RN 24, RNG 15, and RNG 20 are only available upon request





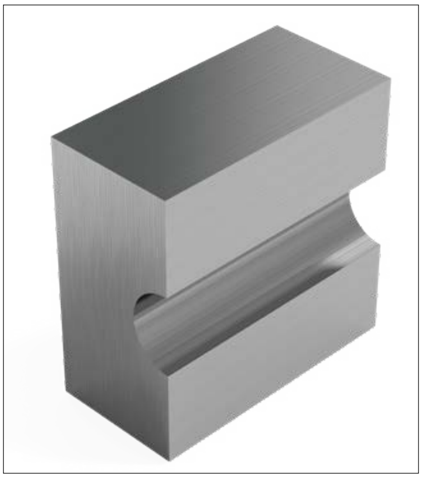


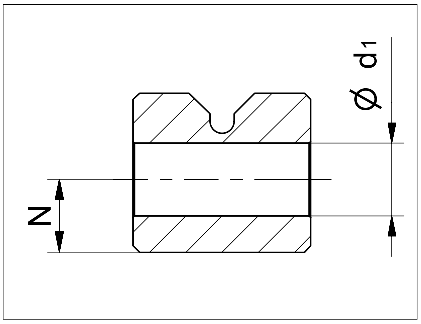


Dimensions for M/V-guideways

Type	N	e_2	g	Ø f_3	Ø f_4
M/V 3015	5.5	M4	-	3.2	-
M/V 4020	7.5	M6	-	5.2	-
M/V 5025	10	M6	15	5.2	5
M/V 6035	11	M8	20	6.8	6.8
M/V 7040	13	M10	25	8.5	8.5
M/V 8050	14	M12	30	10.5	10.3

Special versions type D





Dimensions for R-guideways

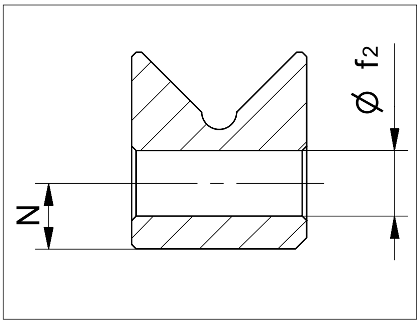
Type	N	Ø d_1
R 1	1.8	1.65
R 2	2.5	2.55
R 3	3.5	3.5
R 6	6	5.5
R 9	9	6.5
R 12	12	8.5
R 15[1)]	14	10.5
R 18[1)]	18	12.5
R 24[1)]	24	14.5

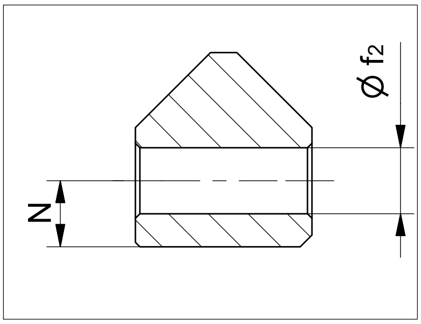
Dimensions for RN-guideways

Type	N	Ø d_1
RN 3	3.5	3.5
RN 4	4.5	4.5
RN 6	6	5.5
RN 9	9	6.5
RN 12	12	8.5
RN 15[1)]	14	10.5
RN 18[1)]	18	12.5
RN 24[1)]	24	14.5

Dimensions for RNG-guideways

Type	N	Ø d_1
RNG 4	3.5	3.5
RNG 6	5	4
RNG 9	6	4.8
RNG 12	8	7
RNG 15[1)]	10	9
RNG 20[1)]	12	10.5





Dimensions for N/O-guideways

Type	N	Ø f_2
N/O 62015	6	5.5
N/O 92025	9	6.5
N/O 2025	10	8.5
N/O 2535	12	10.5
N/O 3045	14	12.5
N/O 3555	14	12.5

Dimensions for M/V-guideways

Type	N	Ø f_2
M/V 3015	5.5	5.3
M/V 4020	7.5	7.5
M/V 5025	10	7.5
M/V 6035	11	10
M/V 7040	13	12.5
M/V 8050	14	14

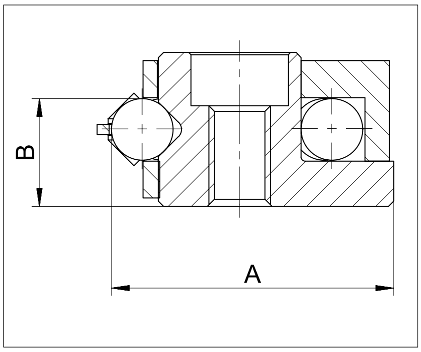
[1)] R 15, R 18, R 24, RN 18, RN 24, RNG 15 und RNG 20 sind nur auf Anfrage erhältlich

8 Recirculating unit options

8.1 Matched recirculating units (GP)

If two or more recirculating units are arranged next to or behind one another, they need to be ordered (matched in pairs) with the add-on designation GP.

SK, SKD, SKC, SR

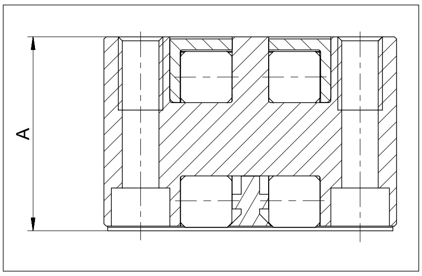


Type	Manufacturing tolerances in mm		Group tolerances in µm within pairs	
	A	B	A	B
SK 1, 2	0/-0.1	+/-0.005	2	2
SK 3, 6, 9, 12[1]	0/-0.1	+/-0.005	3	3
SKD 6, 9, 12[1]	0/-0.1	+/-0.005	3	3
SKC 6, 9	0/-0.1	+/-0.005	3	3
SR 2	0/-0.1	+/-0.005	2	2
SR 3, 6, 9, 12[1]	0/-0.1	+/-0.005	3	3

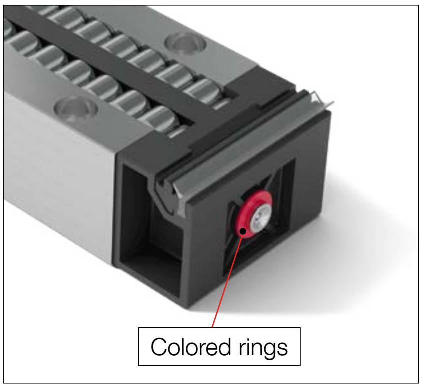
The types in bold are standard. The types in size 12 are available on request

Markings:
The recirculating units in the same group are designated with a number, i.e. the same number corresponds to the exact same tolerance group.

NRT



Type	Manufacturing tolerance A	Sorts in µm	Markings
NRT	-0.025	-20 to -25	white
		-15 to -20	green
		-10 to -15	yellow
		-5 to -10	blue
		0 to - 5	red

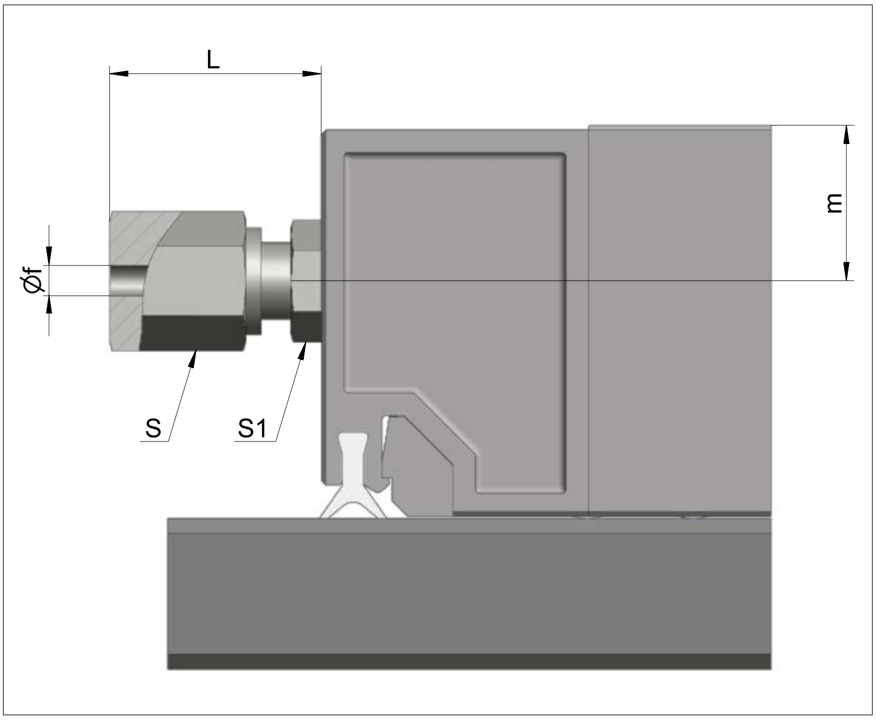


Markings:
Colored rings around the lube nipple mark the relevant tolerance group.

[1] Types of size 12 are only available on request

8.2 Centralised lubricating system (ZS) for recirculating units NRT

Connection variants



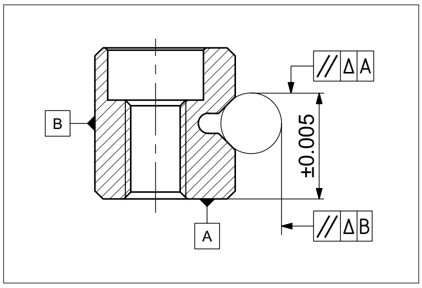
					Wrench size	
Type	**Size**	L	f	m	s	s1
NRT 19077	**ZS-2**	14	2	5.3	8	7
	ZS-3	16	3			
NRT 26111 NRT 26132	**ZS-2**	14	2	10.3	8	7
	ZS-3	16	3			
	ZS-4	20	4		10	8
	ZS-5	20	5			
	ZS-6	22	6		12	10
NRT 38144	**ZS-2**	14	2	14.5	8	7
	ZS-3	16	3			
	ZS-4	20	4		10	8
	ZS-5	20	5			
	ZS-6	22	6		12	10

9 Linear guideways standard parameters

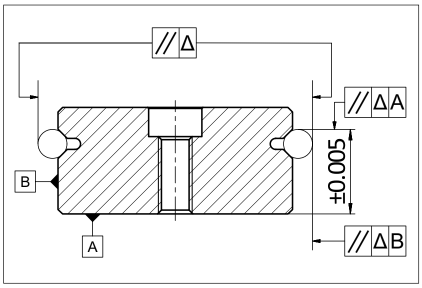
9.1 Tolerance of the supporting surface to the track

In addition to the previously mentioned geometric precision as set out in chapter 7.1, SCHNEEBERGER guideways are also manufactured to the dimensions of the supporting surface in relation to the track within a very tight tolerance (+/- 0.005mm).

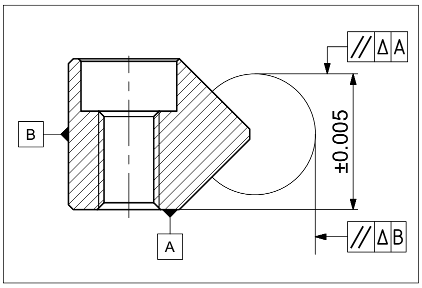
Advantages:
- Interchangeability is guaranteed at all times
- In most cases additional matching of the guideways is surplus to requirement



Type R, RN and RNG

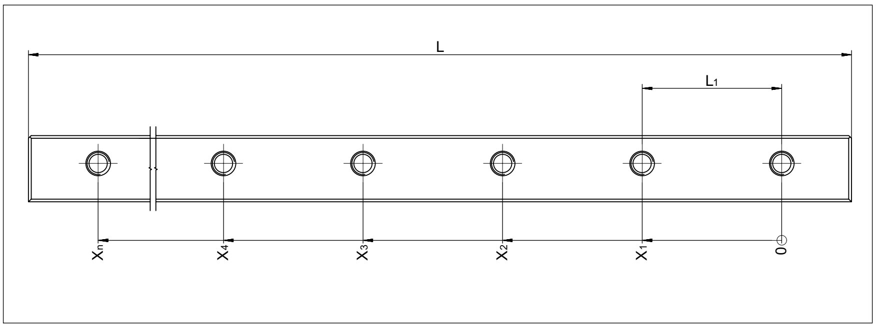


Type RD



Type N/O and M/V

9.2 Length tolerances and distances between fixing holes



Length	L ≤300 mm:	±0.3 mm
Length	L >300 mm:	±0.1 % of L
Hole pitch	L_1:	±0.3 mm
Mass	X_n ≤350 mm:	±0.3 mm
Mass	X_n >350 mm:	±0.08 % of x_n

The fixing holes are manufactured before the hardening process, which is why the length tolerances and spacings differ from the usual standards. The deviations can be offset using undercut fastening screws of type GD or GDN (see chapter 5) and/or by choosing a suitable hole (see chapter 7.10).

9.3 Operating temperatures

SCHNEEBERGER linear guideways can be used at operating temperatures from –40° C to +80° C. For brief periods temperatures up to +120° C are possible.

9.4 Speeds and accelerations

The following limit values apply for the standard designs:

Product	Max. speed	Max. acceleration
Linear guideways R, RD, RN, RNG, N/O and M/V	1 m/s	50 m/s²
Linear guideways RN and RNG with Cage control FORMULA-S	1 m/s	300 m/s²
Linear guideways N/O and M/V with cage control	1 m/s	200 m/s²

9.5 Friction, running accuracy and smoothness

When manufacturing the linear guideways, SCHNEEBERGER places great value on a high level of smoothness. Transitions, run-ins and run-outs or the quality of the synthetic materials and synthetic composite cages are given top priority. This also applies in respect of the rolling elements used, which must satisfy the most stringent quality demands.

For guideways with cages under normal operating conditions a friction factor of 0.0005 to 0.0030 can be assumed.

10 Recirculating unit standard parameters

10.1 Operating temperatures

SCHNEEBERGER recirculating units can be used at operating temperatures from –40° C to +80° C (for brief periods temperatures up to +120° C are possible). For type SKC the temperature range is –150° C to +200° C.

10.2 Speeds and accelerations

The following limit values apply for the standard designs:

Product	max. speed	max. acceleration
SK, SKD, SKC and SR	2 m/s	50 m/s^2
NRT	1 m/s	50 m/s^2

10.3 Friction, running accuracy and smoothness

When manufacturing the recirculating units, SCHNEEBERGER places great value on a high level of smoothness. Transitions, run-ins and run-outs or the quality of the synthetic materials are given top priority. This also applies in respect of the rolling elements used, which must satisfy the most stringent quality demands.

For recirculating units under normal operating conditions a friction factor of 0.005 can be assumed.

The varied areas of application require different characteristics of linear guideways and recirculating units. Various parameters and considerations are critical for product selection. These are described in detail below.

11.1 Linear guideways

Relationship between stroke H and length of the guideway L

If the stroke is below 400 mm, the following formula applies:

$$\frac{H}{L} \leq 0.7$$

If the stroke is above 400 mm, the following formula applies:

$$\frac{H}{L} \leq 1$$

L	= Length of the linear guideway in mm
H	= Possible Stroke in mm

Calculating the cage length K

$$K \leq L - H_1$$

If the stroke is symmetrical, the following formula applies:

$$H = H_1 + H_2 = H_{12}$$

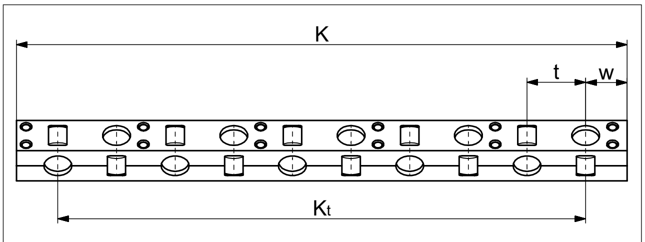
If the stroke is asymmetrical, the following formula applies:

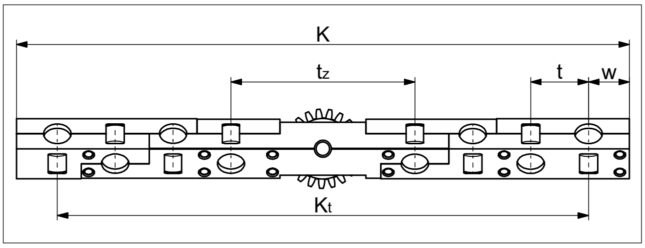
$$H = H_1 + H_1 \qquad H > H_1 + H_2 \qquad H_{12} = H_1 + H_2$$

K	= Cage length in mm
L	= Length of the linear guideway in mm
H	= Possible Stroke in mm
H_1	= Large partial stroke in mm = H/2
H_2	= Small partial stroke in mm = H/2
H_{12}	= Effective partial stroke in mm

The stroke must be limited by means of stops on the table and not by the cages. The stops should preferably be fitted along the axis of symmetry of the guideways to avoid additional forces acting on the linear guideways.

Calculating the number of rolling elements (R_A) per cage





a) For cage types KBN, AA-RF, AC, AK, EE, SHW, HW

$$K = (R_A - 1) \cdot t + 2 \cdot w \quad => \quad R_A = \frac{K - 2 \cdot w}{t} + 1$$

or

$$R_A = \frac{K_t}{t} + 1$$

b) For cage type KBS

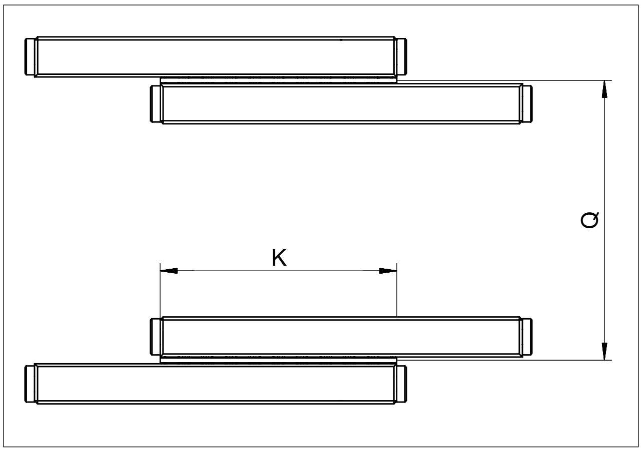
$$K = (R_A - 2) \cdot t + t_z + 2 \cdot w \quad => \quad R_A = \frac{K - (2 \cdot w + t_z)}{t} + 2$$

or

$$R_A = \frac{K_t - t_z}{t} + 2$$

K	= Cage length in mm	t	= cage division in mm
R_A	= Total available rolling element per cage	K_t	= Load-bearing length in mm
w	= Distance from cage start to the middle of the first rolling element in mm	t_z	= Length of the middle section for the KBS cage

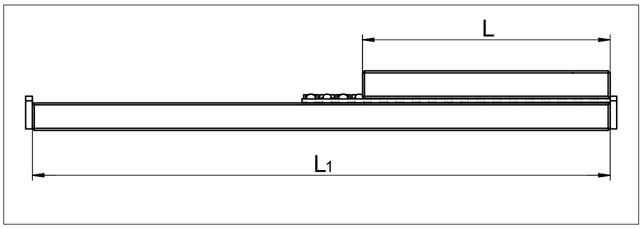
The relationship between the cage length K and the average guideway spacing Q



$$\frac{K}{Q} \geq 1$$

K	= Cage length in mm
Q	= Average linear guideway spacing in mm

The maximum permissible installation ratio in the case of overrunning cages



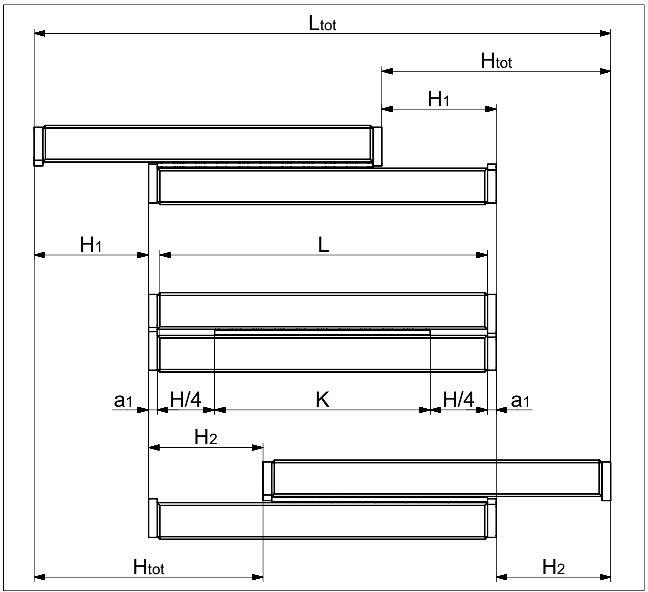
Overrunning cages are expedient if a short table is to be moved on a long guideway track. In each case the short rail for the guideway must have a rounded run-in (special version EG, see chapter 7.3) so that the overrunning cage causes as little pulsation as possible.

Not every cage is suitable for this application. The maximum cage overrun depends on the position of the rails and on the cage material.

Maximum permitted installation ratios L to L_1:
– for fixed guideways 1 : 2
– for laid on guideways 1 : 4

Installation variants for linear guideways

There are four installation variants for linear guideways. The various linear guideways can be also used with wipers in the form of end pieces (a_1)*. In these four cases, the following length ratios result:



Variant 1

Linear guideway with:
- Equal length rails
- Symmetric / asymmetric stroke

a) Without end screws, end pieces, and end pieces with wipers

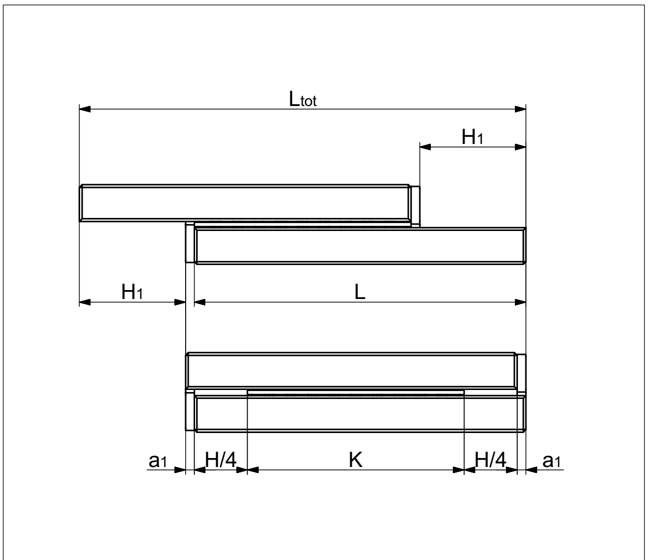
$K \leq L - H_1$

$L_{tot} = L + H_1 + H_2$

b) For end screws, end pieces, and end pieces with wipers**

$K = L - H_1$

$L_{tot} = L + H_1 + H_2 + 2 \cdot a_1$



Variant 2

Linear guideway with:
- Equal length rails
- Unidirectional stroke

a) Without end screws, end pieces, and end pieces with wipers

$K \leq L - H_1$

$L_{tot} = L + H_1$

b) For end screws, end pieces, and end pieces with wipers**

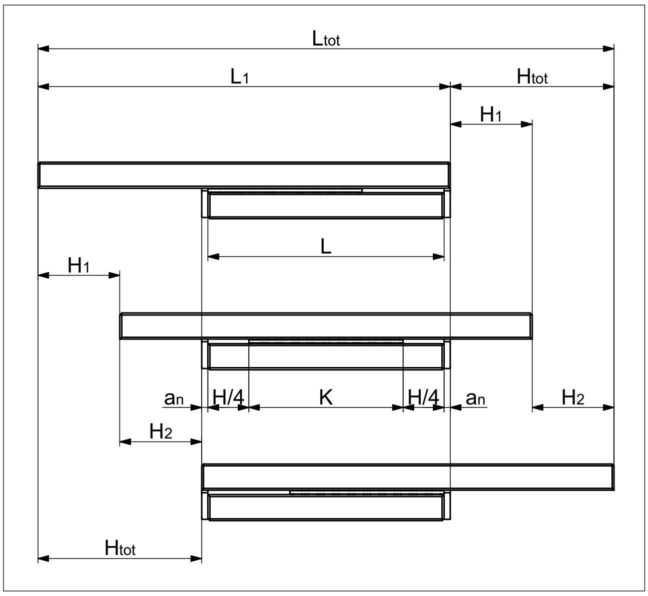
$K \leq L - H_1 - a_1$

$L_{tot} = L + H_1 + a_1$

With this design, the linear guideways must be staggered to one another by the amount a_1.

K	=	Cage length in mm
H	=	Possible Stroke in mm
H_1	=	Large partial stroke in mm = H/2
H_2	=	Small partial stroke in mm ≤ H/2
H_{tot}	=	Effective partial stroke in mm
L	=	Length in mm
L_1	=	Length in mm
L_{tot}	=	Total length in mm
a_n	=	Thickness of the end piece in mm

* a_1 end screws, end pieces, and end pieces with wipers, see chapter 5
** Wipers can influence the run characteristics of the linear guideways



Variant 3

Linear guideway with:
- Unequal length rails
- Symmetric / asymmetric stroke
- Short rails attached

a) Without end screws, end pieces, and end pieces with wipers

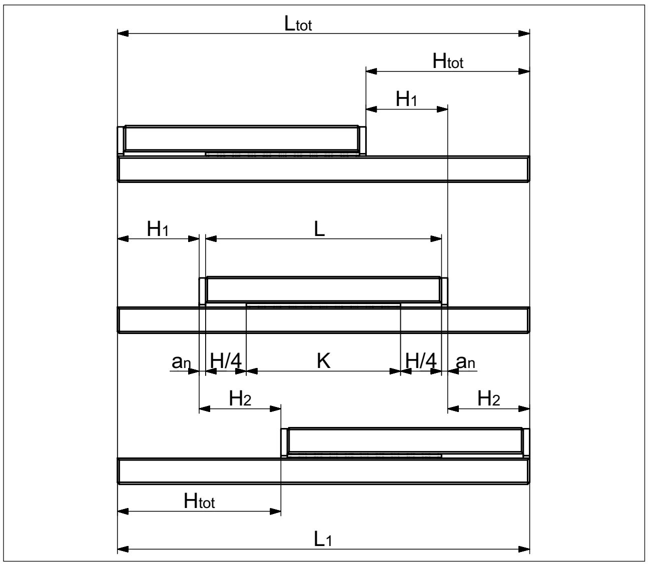
$K \leq L - H_1$

$L_{tot} = L + H_1 + H_2$

b) For end screws, end pieces, and end pieces with wipers**

$K \leq L - H_1 - 2 \cdot a_1$

$L_{tot} = L + H_1 + H_2$



Variant 4

Linear guideway with:
- Unequal length rails
- Symmetric / asymmetric stroke
- Long rails attached

a) Without end screws, end pieces, and end pieces with wipers

$K \leq L - H_1$

$L_{tot} = L + H_1 + H_2$ (wenn $L \geq L_1 - H_{12}$)

$L_{tot} = L_1$ (wenn $L \geq L_1 - H_{12}$)

b) For end screws, end pieces, and end pieces with wipers**

$K \leq L - H_1 - a_1$

$L_{tot} = L + H_1 + H_2 + 2 \cdot a_1$ (wenn $L \geq L_1 - H_{12}$)

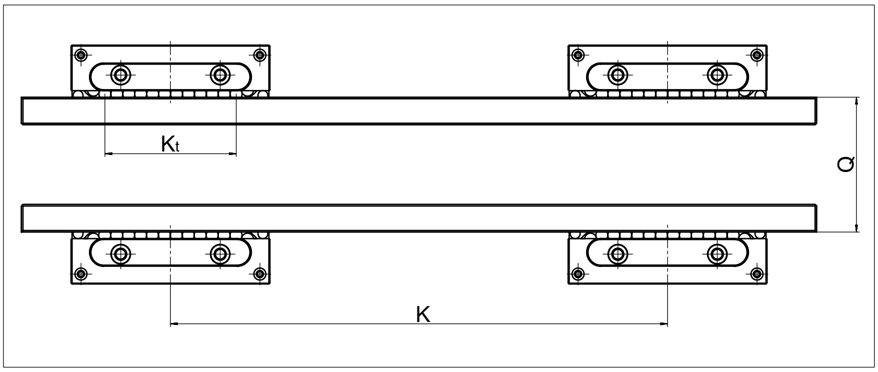
$L_{tot} = L_1$ (wenn $L \geq L_1 - H_{12}$)

K	= Cage length in mm
H	= Possible stroke in mm
H_1	= Large partial stroke in mm = H/2
H_2	= Small partial stroke in mm ≤ H/2
H_{tot}	= Effective partial stroke in mm
L	= Length in mm
L_1	= Length in mm
L_{tot}	= Total length in mm
a_n	= Thickness of the end piece in mm

* a_1 end screws, end pieces, and end pieces with wipers, see chapter 5
** Wipers can influence the run characteristics of the linear guideways

11.2 Recirculating units

When using recirculating units, theoretically there is not restriction in stroke. The stroke is only restricted by the length of the guide rails.



In terms of the spacing K between the recirculating units and the rail spacing Q, the following ratios are recommended as a guideline:

When using **one** recirculating unit per rail: $$\frac{K_t}{Q} \geq 1$$

When using **more than one** recirculating unit per rail: $$\frac{K}{Q} \geq 1$$

K	= Spacing between the recirculating units in mm
K_t	= Load-bearing length in mm
Q	= Average rail spacing in mm

12 Load carrying capacity and service life

12.1 Basic principles

The load capacities are based on DIN ISO standard 14728 for roller-contact bearings.

In accordance with DIN, in most applications a permanent overall deformation of 0.0001 times the rolling element diameter can be permitted without adversely affecting the operating behavior of the bearing. This is referred to as the static capacity, C_0. When designing a new application, we recommend the equivalent static load be in line with the dynamic load capacity (C) to avoid plastic deformation.

The dynamic loading capacity C is the load at which a nominal service life L of 100,000 meters of travel is achieved. It is important to note when calculating the service life that not only the load, which acts vertically on the guideway, should be taken into account but the load range of all acting forces and moments.

The service life corresponds to the travel distance in meters, which is travelled from a guideway. This is before the first sign of material fatigue occurs within the roller guide-way elements. The nominal service life is achieved when 90 % of the guideways of identical construction reach or exceed the corresponding travel distances under nor-mal operating conditions.

Critical for the dimensioning of the guideways are the loads occurring in the ratio with the dynamic loading capacity C.

Definition of service life

As previously mentioned, the dynamic loading capacity C_{100} is based on a service life of 100,000 meters. Other manufacturers frequently indicate the loading capacity C_{50} for a service life of 50,000 meters. The resulting load capacities from this are more than 20 % higher than specified in the DIN ISO standard.

Conversion examples

For balls
Convert load capacities in accordance with DIN ISO standard to C_{50}:
$C_{50} = 1.26 \cdot C_{100}$
Convert C_{50} load capacities in accordance with DIN ISO standard to:
$C_{100} = 0.79 \cdot C_{50}$

For rollers and needles
Convert load capacities in accordance with DIN ISO standard to C_{50}:
$C_{50} = 1.23 \cdot C_{100}$
Convert C_{50} load capacities in accordance with DIN ISO standard to:
$C_{100} = 0.81 \cdot C_{50}$

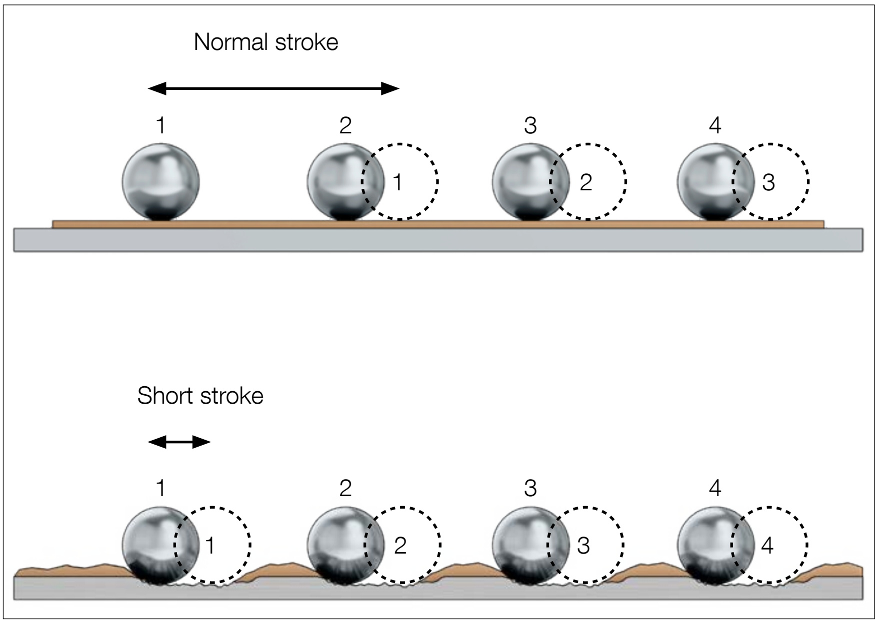
C_{50} = dynamic loading capacity C in N for 50,000 meters of travel distance
C_{100} = dynamic loading capacity C in N for 100,000 meters of travel distance defined in accordance with DIN ISO standard

12.2 Short strokes

We talk about short stroke applications when a rolling element does not travel past the position of the next rolling element during a stroke.

A continuous lubricating film forms below the rolling element

Local depressions from wear and tear form on the tracks.
At highly frequent strokes the lubricating film is also interrupted



Because the tracks are concentrated at these points (depressions from wear and tear form), the precision and service life of the guideway is reduced. When the strokes are highly frequent, a standard lubricant is no longer able to reach the points of contact.

Wear and tear can be deferred with **suitable lubricants** and regular **lubrication strokes**.

Short strokes curtail the service life of the guideway considerably. The service life of the guideway(s) can only be determined by means of testing.

12.3 Calculating the service life L in accordance with the DIN ISO standard

The formulas for calculating service life are:

For rollers and needles:

$$L = a \cdot \left(\frac{C_{eff}}{P}\right)^{\frac{10}{3}} \cdot 10^5\,\mathrm{m}$$

For balls:

$$L = a \cdot \left(\frac{C_{eff}}{P}\right)^{3} \cdot 10^5\,\mathrm{m}$$

a	= Event probability factor
C_{eff}	= Effective load carrying capacity per rolling element in N
P	= Dynamic, equivalent load in N
L	= Nominal service life in m

Event probability factor a

The load carrying capacities for roller-contact bearings correspond to the DIN ISO standard. This represents a value from the service life calculation, which is exceeded with a probability of 90 % during operational use of the guideway.

If the previously mentioned theoretical service life probability factor of 90% is not adequate, the service life values will need to be adjusted by a factor a.

Event probability in %	90	95	96	97	98	99
Factor a	1	0.62	0.53	0.44	0.33	0.21

Effective load carrying capacity C_{eff}

External influences such as track hardness and temperature can reduce the loading capacity C which means that C_{eff} needs to be calculated.

$C_{eff} = f_H \cdot f_T \cdot C$

C_{eff}	= Effective load carrying capacity per rolling element in N
f_H	= Hardness factor
f_T	= Temperature factor
C	= Max. permissible load carrying capacity per rolling element in N

Hardness factor f_H

Materials in a frictionless guideway, which deviate from the standard conditions (HRC 58 - 62), can be recorded with the factor f_H:

Track hardness in HRC	20	30	40	50	55	56	57	58-62
Hardness factor f_H	0.1	0.2	0.3	0.6	0.8	0.88	0.95	1

Temperature factor f_T

Increased temperatures influence the operating conditions (material properties) and must be taken into account using the factor f_T.

Temperature of the guideway in °C	150	200	250	300
Temperature factor f_T	1	0.9	0.75	0.6

Example calculation for C_{eff}

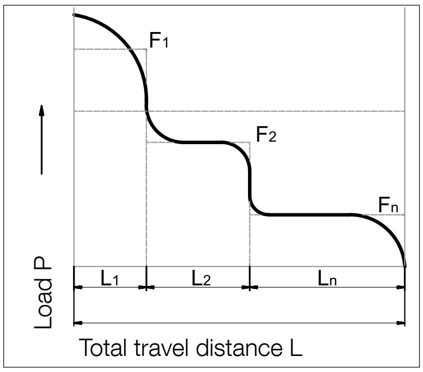
Guideway type R6 => Hardness 58 - 62 HRC => $f_H = 1$
Temperature 200°C => $f_T = 0.9$
Cage AA 6 => C = 530 N per roller

$C_{eff} = f_H \cdot f_T \cdot C = 1 \cdot 0.9 \cdot 530 = \underline{477\ N}$

Dynamically equivalent load P

The loads (F) acting on a linear guideway system are subject to frequent fluctuations during operation. This set of circumstances should be taken into account when calculating service life. The varying load absorption of the guideway at varying operating conditions during the travel distance is described as being the dynamic equivalent load P.

Stepped load



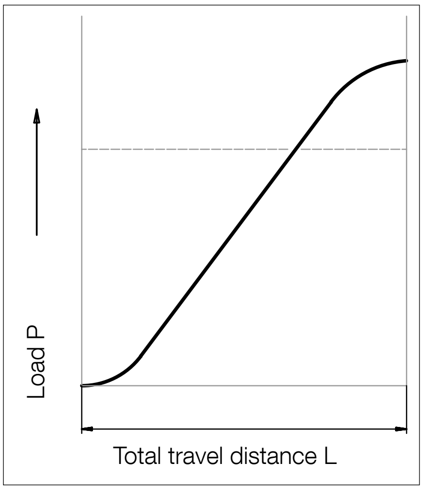
Formula for rollers and needles:

$$P = \sqrt[\frac{10}{3}]{\frac{1}{L}\left(F_1^{\frac{10}{3}} \cdot L_1 + F_2^{\frac{10}{3}} \cdot L_2 + \ldots F_n^{\frac{10}{3}} \cdot L_n\right)}$$

Formula for balls:

$$P = \sqrt[3]{\frac{1}{L}\left(F_1^{3} \cdot L_1 + F_2^{3} \cdot L_2 + \ldots\ F_n^{3} \cdot L_n\right)}$$

Sinusoidal load



$$P = 0.7\,F_{max}$$

P	= Equivalent load in N
$F_1 \ldots F_n$	Individual load in N during the partial travel distance L …. L_n
F_{max}	= Max. load in N
L	= L_1 + …+ L_n = total travel during one load cycle in mm
$L_1 \ldots L_n$	= partial travel distance in mm of one individual load during a load cycle

Example calculation with a linear guideway of type RNG 6-300 with KBN 6 cage

- an event probability of 97% is selected; the corresponds to a factor a of 0.44
- the dynamic loading capacity of a roller (for KBN 6 cage) is 1'800 N. If 16 rollers are used, the loading capacity of the guideway is 16 · 1'800 N = (28'800 N)
- the application generates a total load on to the guideway of 10'000 N

With the previously mentioned values, the following calculation for service life L is:

$$L = \quad a \cdot \left(\frac{C_{eff}}{P}\right)^{\frac{10}{3}} \cdot 10^5$$

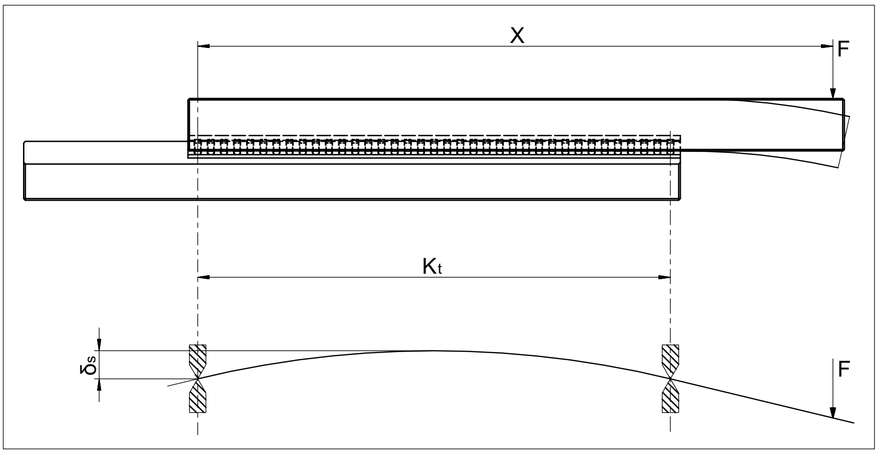
$$L = 0.44 \cdot \left(\frac{28'800\ N}{10'000\ N}\right)^{\frac{10}{3}} \cdot 10^5 = 1'495'412\ m$$

If the service life is requested in hours, the travelled stroke H (in meters) and the time t (in seconds) required for the stroke movement must be known.

The service life L_h is calculated as follows:

$$L_h = \frac{L \cdot t}{H \cdot 3'600} = \text{Service life in hours}$$

The correction factor R_{tmin}



It was explained on the above pages how service life should be calculated from the given load carrying capacity and the occurring load. In doing so, the number of load bearing rolling elements per cage (R_t) should be taken into account.

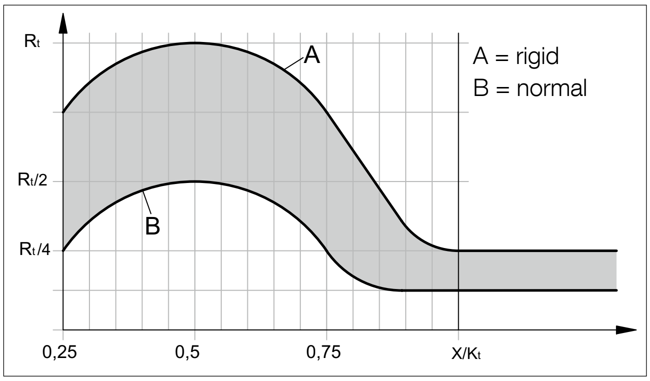
Similarly important is estimating the behavior of the surrounding structure when transmitting forces to the frictionless guideway. Then an elastic deformation or a geometric error in a machine bed lead to the fact that only a part of the installed rolling element effectively absorbs load.

Reliable statements on this application-specific issue can usually only be made with a great deal of difficulty, for example by taking measurements on functioning models or using calculations based on the method of finite elements. The result of this is that normally dimensioning takes place by taking simplified measures, i.e. the external load is divided up on to few rolling elements using the correction factor R_{tmin}.

To determine R_{tmin} first of all the connecting structure must be assessed based on the following values from historical experience:

A = Rigid structure
$\delta_S \leq 0.1 \cdot \delta_A$
B = Normal structure
$\delta_S > \delta_A$

δ_S = deformation of the connecting structure in µm
δ_A = deformation of the rolling element including the guide rail in µm (see chapter 12.5)
F = load in N
X = Lever arm distance on x-axis in mm
K_t = load-bearing cage length in mm
R_t = Number of load-bearing rollers
R_{tmin} = Correction factor



To calculate R_{tmin} according to the diagram applies

structure	A (rigid)	B (normal)
$X > K_t$	R_{tmin} to $R_T/4$	R_{tmin}
$X < K_t$	as per diagram	as per diagram

For R_{tmin} the following applies	Rolling element type	Cage types
2	Balls	AK
1	Rollers	AA, AC, EE, KBN and KBS
5	Needles	SHW and HW
0.5	Recirculating unit with rollers	SR and NRT
1	Recirculating unit with balls	SK, SKD and SKC

Example calculation no. 1

Linear guideway R6 with cage type AK 6/20
X = 200 mm
K_t = 171 mm
Consequently the calculation method
in accordance with "$X > K_t$" applies

The linear guideway is horizontally arranged
Thus, the following applies:
- $R_t = R_A/2 = 20/2 = 10$ rollers

Calculation for a rigid structure:
- In accordance with the table, a ball count R_{tmin} to $R_t/4$ applies
- R_{tmin} corresponds to 2 balls
- $R_t/4$ corresponds to 2.50 balls

Calculation for a normal structure:
- In accordance with the table, R_{tmin} applies
- R_{tmin} corresponds to 2 balls

Example calculation no. 2

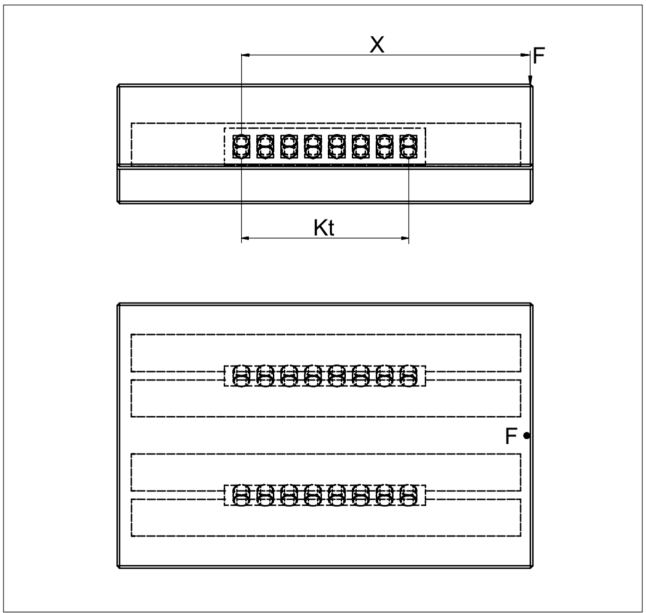
Linear guideway R6 with cage type AK 6/11
X = 75 mm
K_t = 90 mm
Consequently the calculation method
in accordance with «$X < K_t$» applies

Calculation for a rigid structure:
According to the diagram, X = 0.83 of K_t
(75 mm : 90 mm) and consequently $R_t/2$
With 11 load-bearing balls, this results in 5.5 balls
(11 load-bearing balls : 2)

Calculation for a normal structure:
According to diagram $R_t/8$.
With 11 load-bearing balls, this results in 1.3 balls (11 : 8)

12.4 Example calculations

The following example calculations illustrate the procedure for some typical problems.



Example 1

Searched for:
Equivalent load P per roller

Assumption:
Linear guides type R 6
AC 6 cage with 8 rollers (= RA)
F = 350 N
X = 120 mm

For the roller cage type AC 6 the following applies:
K_t = $(R_A - 1) \cdot t = (8 - 1) \cdot 9 = 63$
R_{tmin} = 1 roller
C = 530 N
(per chapter 5.1 techn. specifications of AC 6 cage)

Note:
The asymmetric distribution of force is most safely taken into account when the load on the number of load bearing rolling elements (R_{tmin}) for the guideway is reduced.

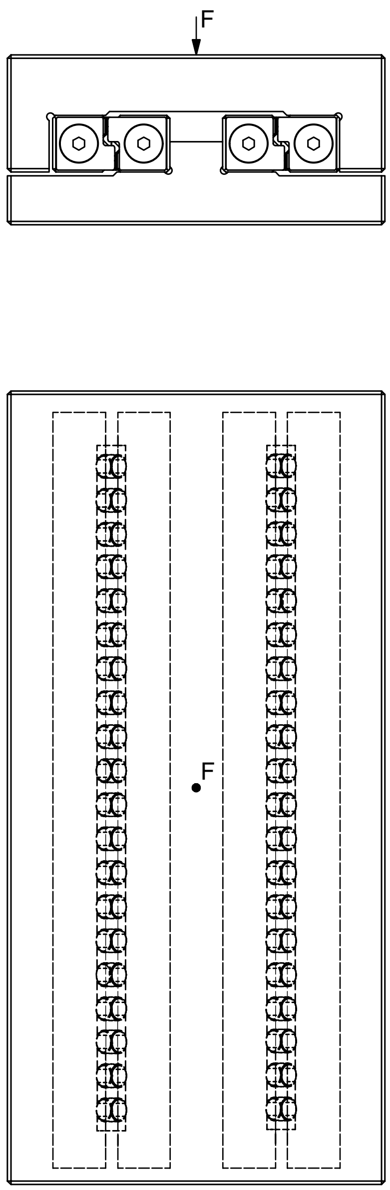
Calculation for P per roller

$$P = \frac{F \cdot x}{K_t \cdot 2} \cdot \frac{1}{R_{tmin}}$$

$$= \frac{350 \cdot 120}{63 \cdot 2} \cdot \frac{1}{1} = 334\ N$$

P is smaller than C. The design is correct in this way.

P	= Equivalent load in N per roller
F	= load in N
C	= Max. permissible load carrying capacity per rolling element in N
X	= Lever arm distance on x-axis in mm
R_A	= Total available rolling element per cage
R_{tmin}	= Correction factor
t	= cage division in mm
K_t	= Load-bearing length in mm



Example 2

Searched for:
Equivalent load P per roller

Assumption:
Linear guides type R 6
Roller cage type AC 6 cage with 20 rollers (= R_A)
F = 6500 N
C = 530 N (per chapter 5.1 techn. specifications of AC 6 cage)

$$R_T = \frac{R_A}{2}$$

$$= \frac{20}{2} = 10\ rollers$$

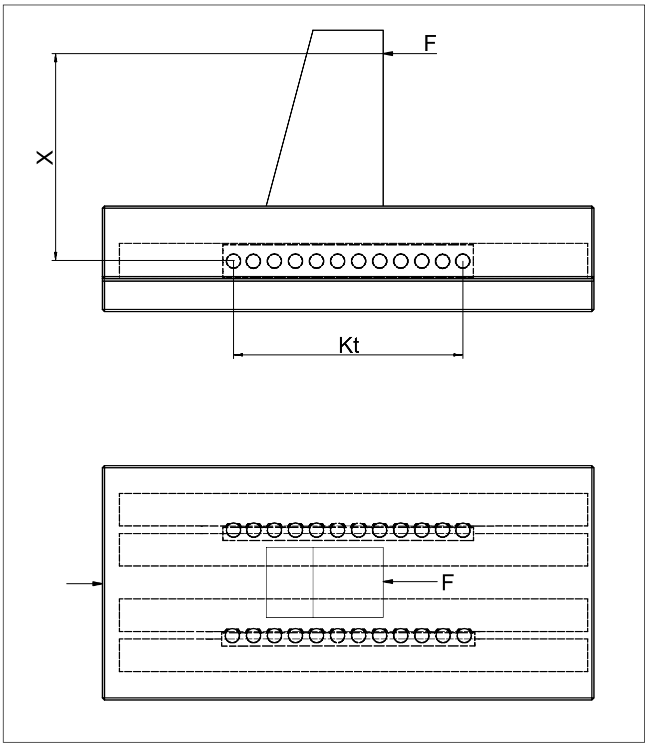
Calculation for P per roller

$$P = \frac{F}{2} \cdot \frac{1}{R_T}$$

$$= \frac{6'500}{2} \cdot \frac{1}{10} = 325\ N$$

P is smaller than C. The design is correct in this way.

w	= Distance from cage start to the middle of the first rolling element in mm
t	= cage division in mm
P	= Equivalent load in N per roller
F	= load in N
C	= Max. permissible load carrying capacity per rolling element in N
R_A	= Total available rolling element per cage
R_t	= Number of load-bearing rolling elements per cage



Example 3

Searched for:
Equivalent load P per ball

Assumption:
Rigid slide structure
Linear guides type R 6
Cage type AK 6 with 12 balls (= RA); t = 9 mm
(according to chapter 5.1, technical data for the AK 6 cage)

R_A	$= R_T$	= 12 balls
R_{tmin}	= 3	$= R_t/4$ according to diagram on page 101
K_t	$= (RA - 1) \cdot t$	
F	= 240 N	
X	= 75 mm (distance F to opposing force)	
C	= 65 N (according to chapter 5.1, technical data for the AK 6 cage)	

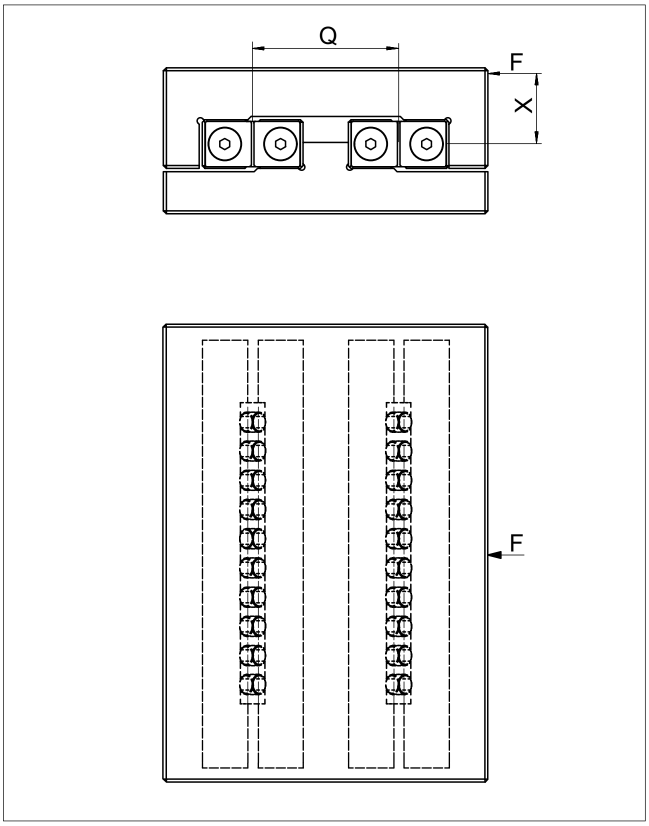
Calculation for P per ball:

$$P = \frac{F}{K_t} \cdot \frac{X}{2} \cdot \frac{1}{R_{tmin}}$$

$$= \frac{240}{99} \cdot \frac{75}{2} \cdot \frac{1}{3} = 30\ N$$

P is smaller than C. The design is correct in this way.

t	= cage division in mm
P	= Equivalent load in N per ball
F	= load in N
C	= Max. permissible load carrying capacity per rolling element in N
R_{tmin}	= Correction factor
R_A	= Total available rolling elements per cage
R_t	= Number of load-bearing rolling elements per cage
K_t	= Load-bearing length in mm



Example 4

Searched for:
Equivalent load P per roller and the suitable size RNG guideways

Assumption:
Type RNG linear guideways
Roller cage type KBN with 10 rollers (R_A)
F = 15'000 N
X = 50 mm
Q = 100 mm

$$R_T = \frac{R_A}{2} = \frac{10}{2} = 5\ rollers$$

Calculation for P per roller

$$P_1 = \frac{F \cdot X}{Q} \cdot \frac{1}{R_T} = \frac{15'000 \cdot 50}{100} \cdot \frac{1}{5} = 1'500\ N$$

$$P_2 = \frac{F}{R_A} = \frac{15'000}{10} = 1'500\ N$$

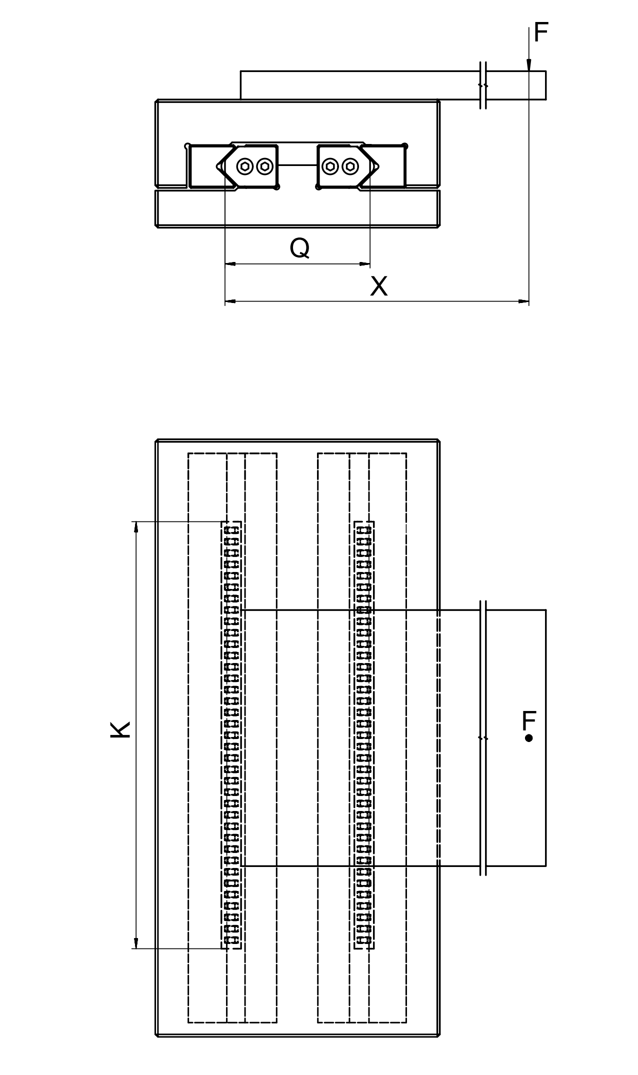
$$P = P_1 + P2 = 1'500 + 1'500 = 3'000\ N$$

P (P1, P2)	= Equivalent loads in N per roller
F	= load in N
X	= Lever arm distance on x-axis in mm
Q	= Medium linear guideway distance in mm
C	= Max. permissible load carrying capacity per rolling element in N
R_A	= Total available rolling element per cage
R_t	= Number of load-bearing rolling elements per cage

Definition of the suitable guideway size:
According to product specification for the KBN cage (chapter 5.2 or 5.3) if C = 3'900 N were to be selected

Type	Size	Dw	t	w	C per roller in N
KBN	4	4.5	6.5	approx. 4	850
	6	6.5	8.5	approx. 5	1800
	9	9	12	approx. 7.5	3900
	12	12	15	approx. 9	6500

The roller size 9 is suitable. Thus select cage KBN 9 and the linear guideway RNG 9, provided the service life has been fulfilled.



Example 5

Searched for:
Equivalent load P per needle

Assumption:
Linear guideways type N/O 2025
SHW 15 cage, cage length K = 194 mm
(w = 2.9 mm according to techn. specifications of the SHW 15 cage)

F = 5'000 N
X = 280 mm
Q = 75 mm
C = 750 N (according to techn. specifications for the AC 15 cage)

$$R_A = \left(\frac{K - 2w}{t} + 1\right) \cdot 2$$

$$= \left(\frac{194 - 5.8}{4} + 1\right) \cdot 2 = 96 \; needles$$

$$R_t = \frac{R_A}{2} = 48 \; needles$$

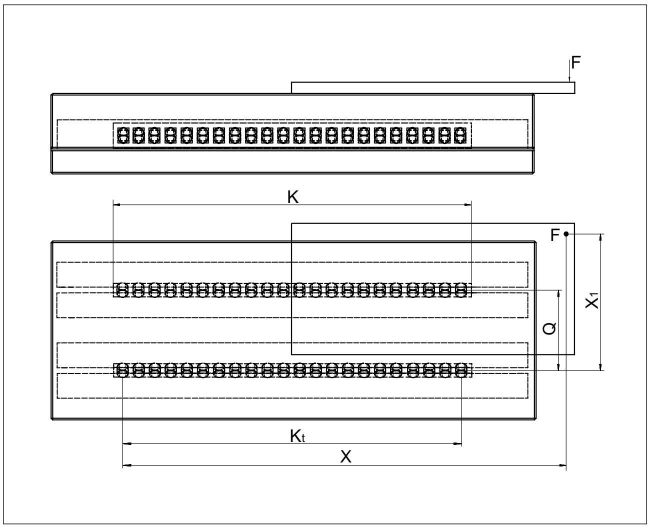
Calculation for P per needle:

$$P = \frac{F \cdot X}{Q} \cdot \frac{1}{R_t}$$

$$= \frac{5'000 \cdot 280}{75} \cdot \frac{1}{48} = 389 \; N$$

P is smaller than C. The design is correct in this way.

w	= Distance from cage start to the middle of the first rolling element in mm
t	= cage division in mm
P	= Equivalent load in N per needle
F	= load in N
X	= Lever arm distance on x-axis in mm
Q	= Medium linear guideway distance in mm
C	= Max. permissible load carrying capacity per rolling element in N
R_t	= Number of load-bearing rolling elements per cage
R_A	= Total available rolling element per cage
K	= Cage length in mm



Example 6

Searched for:
Equivalent load P per roller

Assumption:
Rigid structure
Linear guides type R 12
Cage type AC 12, length K = 400 mm
F = 2'000 N
X = 500 mm
X_1 = 200 mm
Q = 100 mm
C = 2'500 N (see chapter 5.1, technical specifications for the AC 12 cage)

For the roller cage AC 12 the following applies:

$$K_t = K - 2w = 400 - 22 = 378\ mm$$

$$R_A = \frac{K_t}{t} + 1 = \frac{378}{18} + 1 = 22\ rollers$$

$$R_t = \frac{R_A}{2} = \frac{22}{2} = 11\ rollers$$

$$X > K_t = R_t/4 \quad \textit{(according to the diagram on page 101)}$$

$$R_{TQ} = R_t$$

$$R_{TL} = \frac{R_t}{4} = \frac{11}{4} = 2.75\ rollers\ (rounded\ down\ to\ 2)$$

Calculation for P per roller

Load laterally

$$P_Q = \frac{F \cdot X_1}{Q} \cdot \frac{1}{R_{TQ}} = \frac{2'000 \cdot 200}{100} \cdot \frac{1}{11} = 364\ N$$

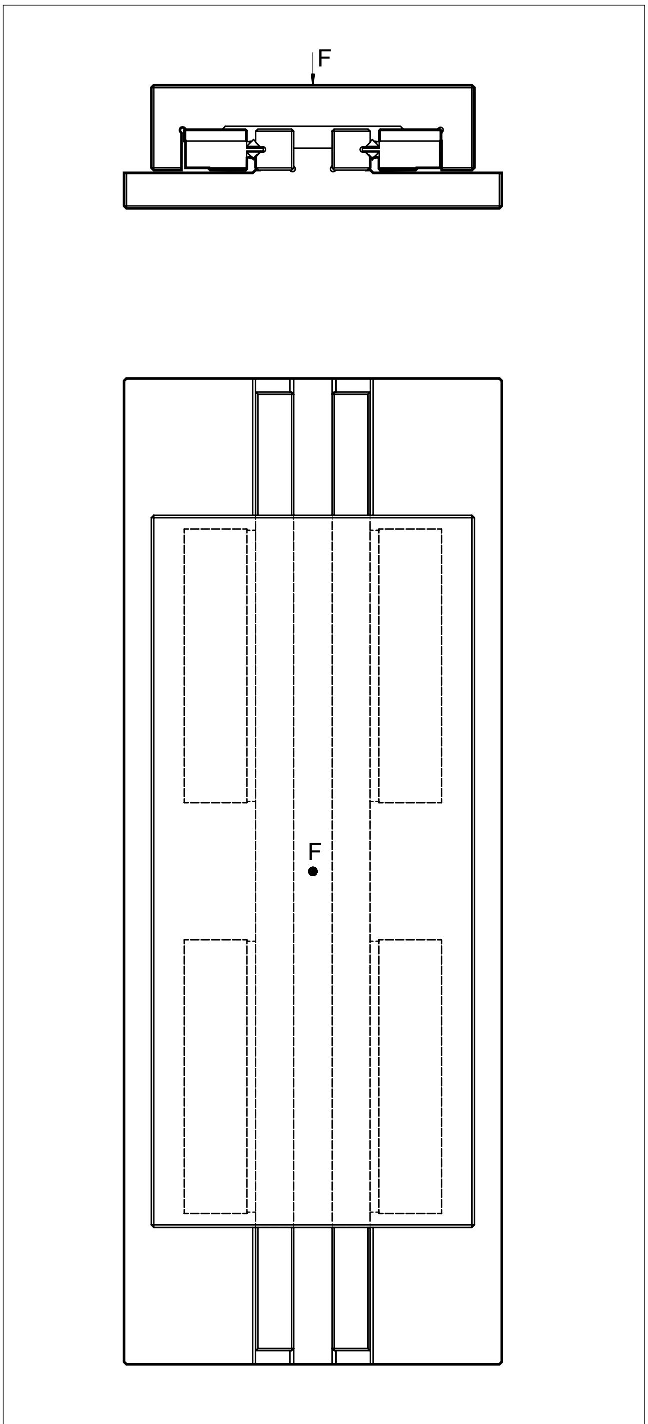
Load longitudinally

$$P_L = \frac{F \cdot X}{K_t \cdot 2} \cdot \frac{1}{R_{TL}} = \frac{2'000 \cdot 500}{378 \cdot 2} \cdot \frac{1}{2} = 662\ N$$

$$P = P_Q + P_L = 364 + 662 = 1'026\ N$$

P is smaller than C. The design is correct in this way.

w = Distance from cage start to the middle of the first rolling element in mm
t = cage division in mm
P = Equivalent load in N per roller
F = load in N
X = Lever arm distance on x-axis in mm
X_1 = Lever arm distance 1 on x-axis in mm
Q = Medium linear guideway distance in mm
C = Max. permissible load carrying capacity per rolling element in N
R_t = Number of load-bearing rolling elements per cage
R_A = Total available rolling element per cage
K = Cage length in mm
K_t = Load-bearing length in mm
$..._L$ = Longitudinally
$..._Q$ = Laterally



Example 7

Searched for:
Equivalent load P

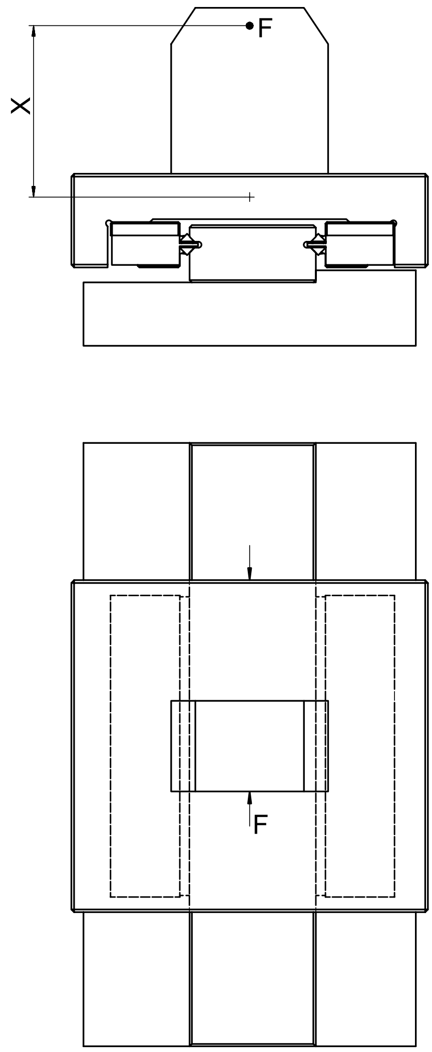
Assumption:
Recirculating unit type SR 6-100
Linear guides type R 6
R_t = 2 recirculating unit
F = 6'000 N
C = 2'150 N (see chapter 6.3, technical specifications for the recirculating unit)

Calculation for P:

$$P = \frac{F}{2} \cdot \frac{1}{R_t}$$
$$= \frac{6'000}{2} \cdot \frac{1}{2} = 1'500\ N$$

P is smaller than C. The design is correct in this way.

P	= Equivalent loads in N
F	= load in N
C	= Max. permissible load carrying capacity in N
R_t	= Number of load-bearing recirculating units



Example 8

Searched for:
Moment load M in Nm longitudinally and laterally

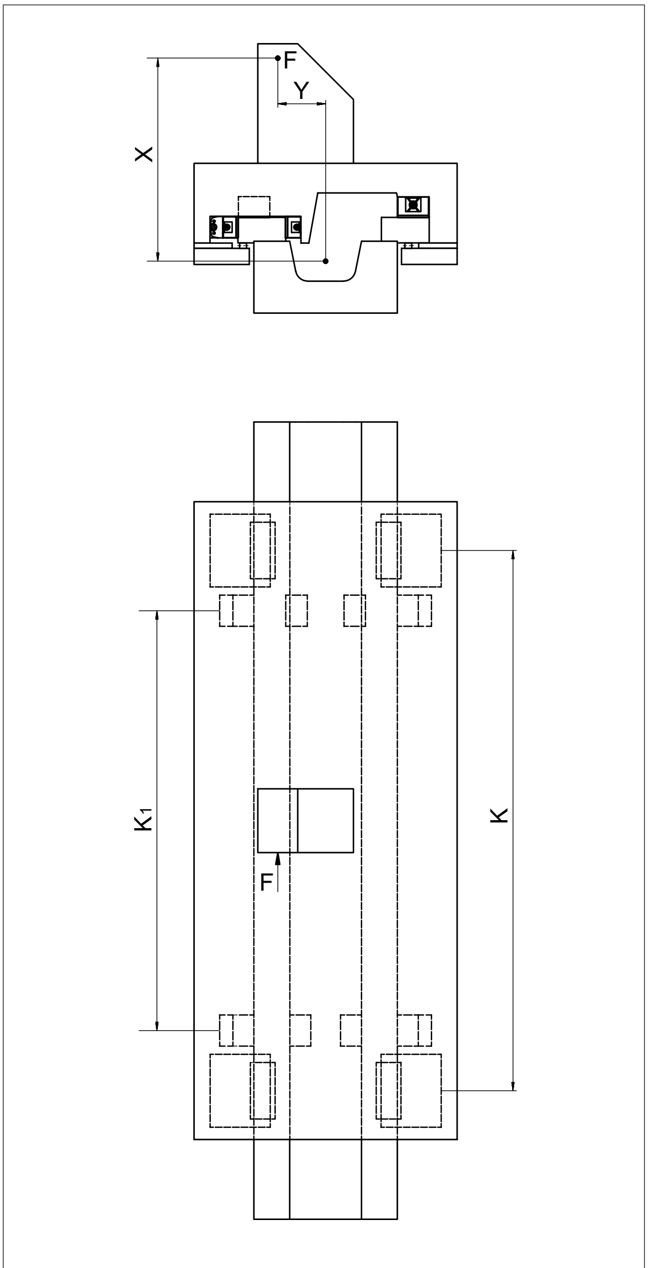
Assumption:
Recirculating unit type SR 6-150
Linear guideways type RD 6
M_L = 112 Nm (according to chapter 6.3, technical specifications
for the recirculating unit)
X = 45 mm (distance F to opposing force)
F = 2'000 N

Calculation for M:

$$M = \mathrm{F} \cdot \mathrm{X} = 2000 \cdot 0{,}045 = 90\ \mathrm{Nm}$$

The moment load M is below the permissible load M_L. Thus the design is correct.

M	= Moment load in Nm longitudinally and laterally
M_L	= Permitted moment load in Nm longitudinally and laterally
X	= distance in mm
F	= load in N



Example 9

Searched for:
Equivalent loads P_L and P_Q

Assumption:
Recirculating unit top type NRT 26 111 (C = 98'000 N)
Recirculating unit bottom type NRT 19 077 (C = 43'000 N)
Recirculating unit side type NRT 19 077 (C = 43'000 N)
K = 700 mm
K_1 = 450 mm
R_{tmin} = 0.5 (according to table on page 101)
F = 83'000 N
X = 500 mm
Y = 100 mm

Calculation for P_L and P_Q:

Load longitudinally

$$P_L = \frac{F \cdot X}{K \cdot 2} \cdot \frac{1}{R_{Tmin}}$$

$$= \frac{83'000 \cdot 500}{700 \cdot 2} \cdot \frac{1}{0.5} = 59'286\ N$$

Load laterally

$$P_Q = \frac{F \cdot Y}{K_1 \cdot 2} \cdot \frac{1}{R_{tmin}}$$

$$= \frac{83'000 \cdot 100}{450} \cdot \frac{1}{0.5} = 36'889\ N$$

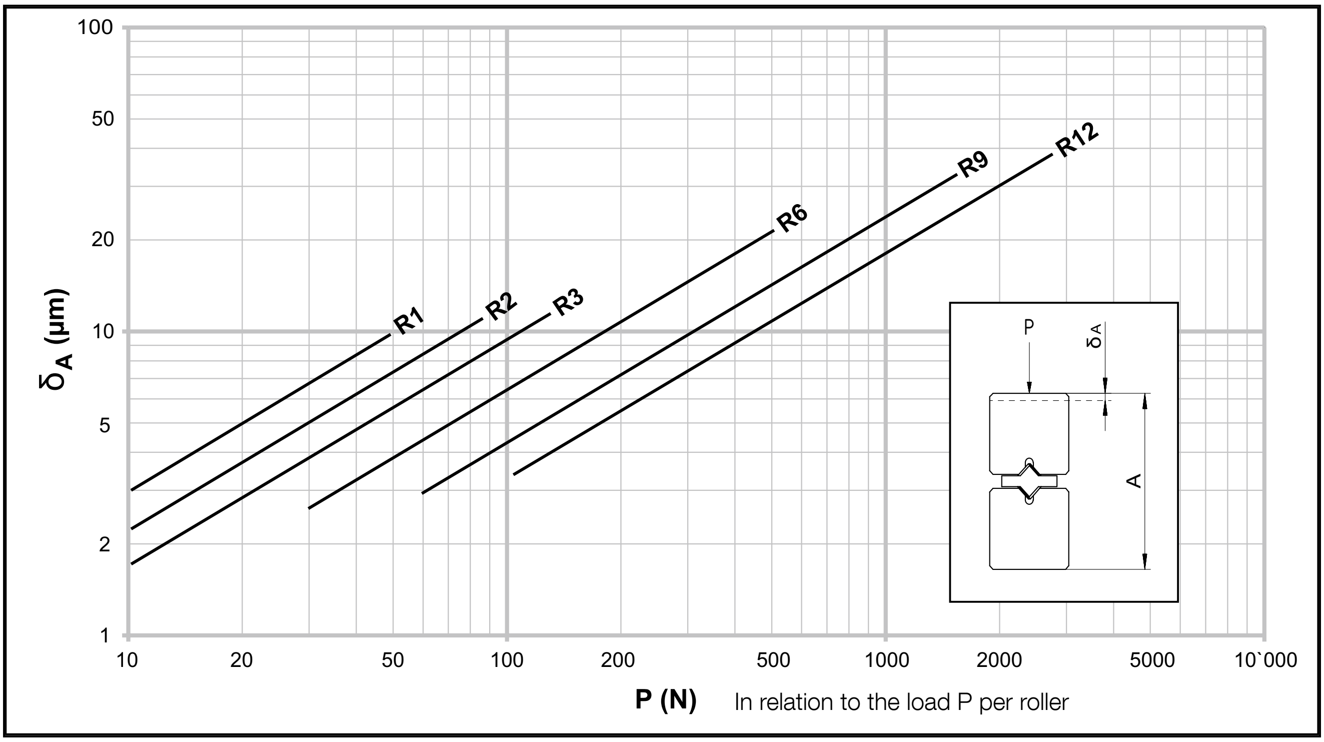
P	= Equivalent load in N
P_L	= Equivalent load longitudinally in N
P_Q	= Equivalent load laterally in N
F	= load in N
X	= distance in mm
Y	= distance in mm
C	= Max. permissible load carrying capacity per recirculating unit in N
R_{tmin}	= Correction factor
K	= Spacing between the recirculating units in mm
K_1	= Spacing between the recirculating units in mm

12.5 Elastic deformation and rigidity of linear bearings

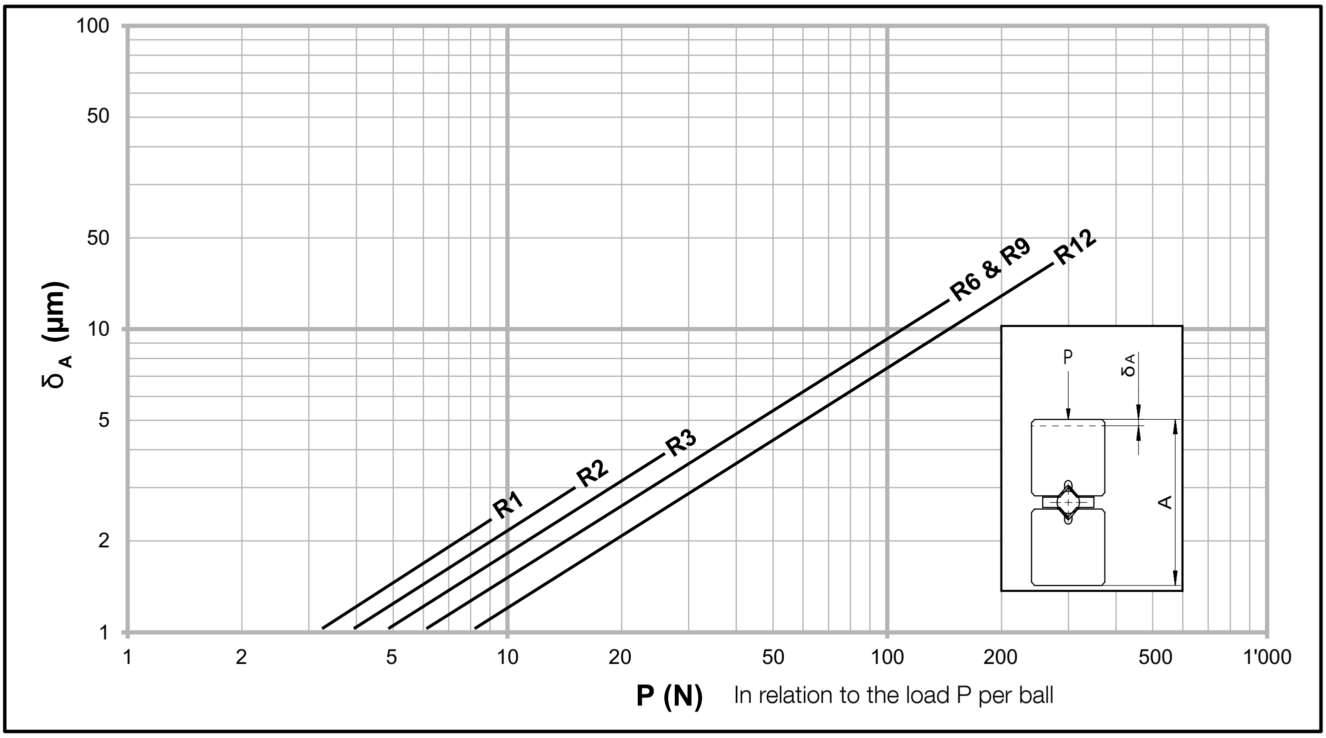
Linear guideways

The total deformation δ_A (that is the deformation of the rolling element in connection with hardened tracks (min. 58 HRC)) can be deduced from the following diagrams.

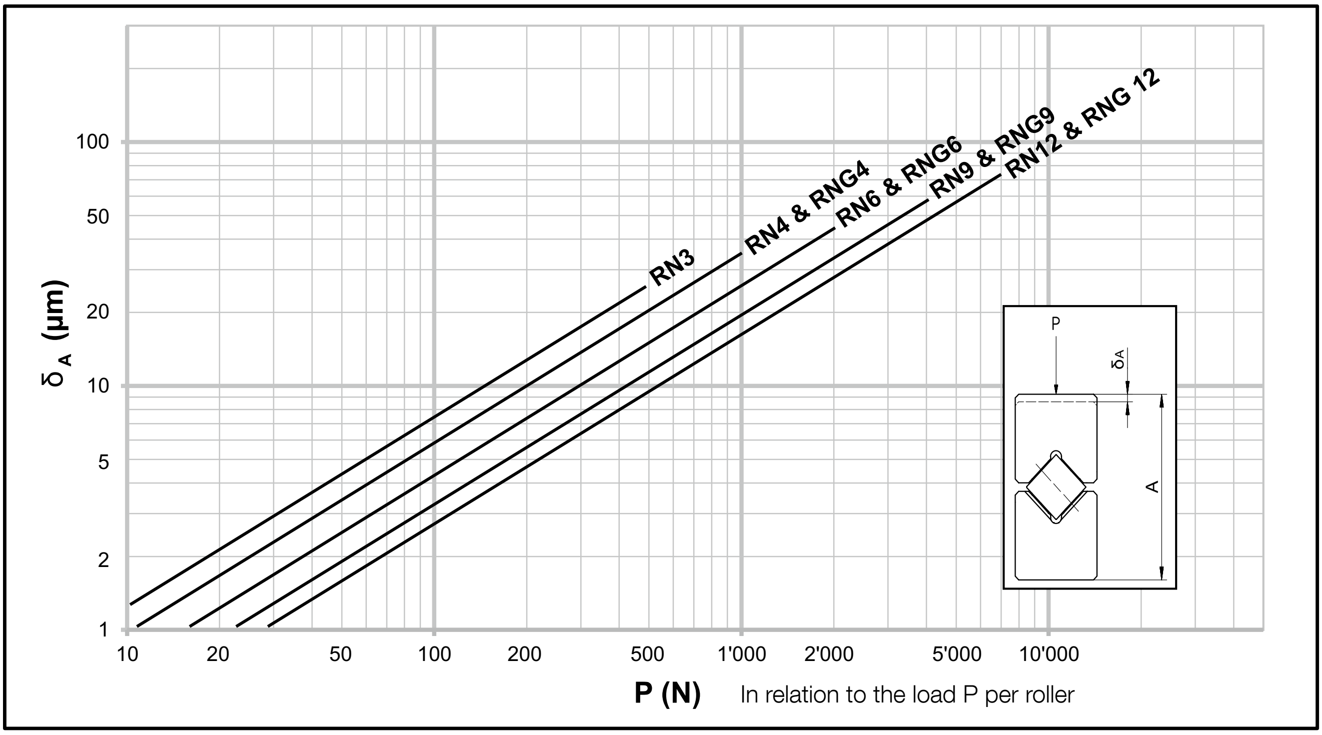
The elastic deformation of the linear guideways of type R with rollers



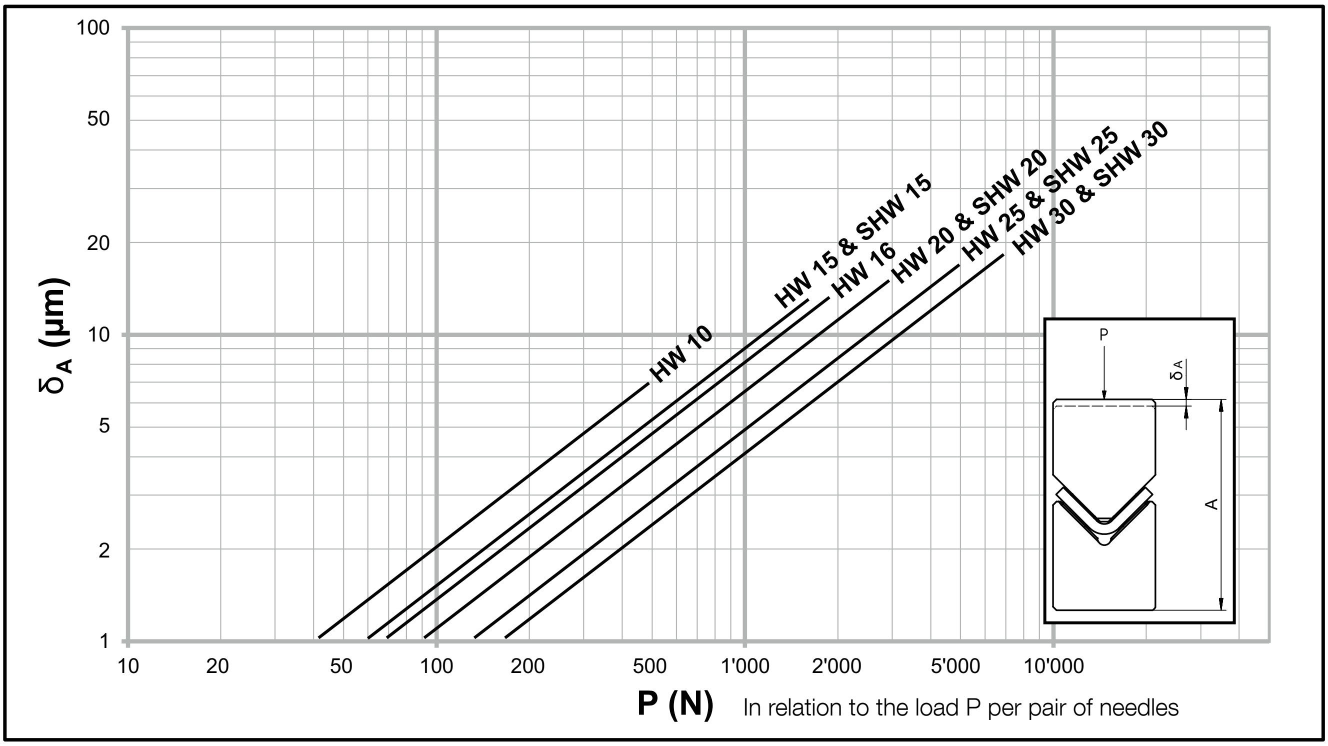
The elastic deformation of the linear guideways of type R with balls



The elastic deformation of the linear guideways for type RN and RNG.

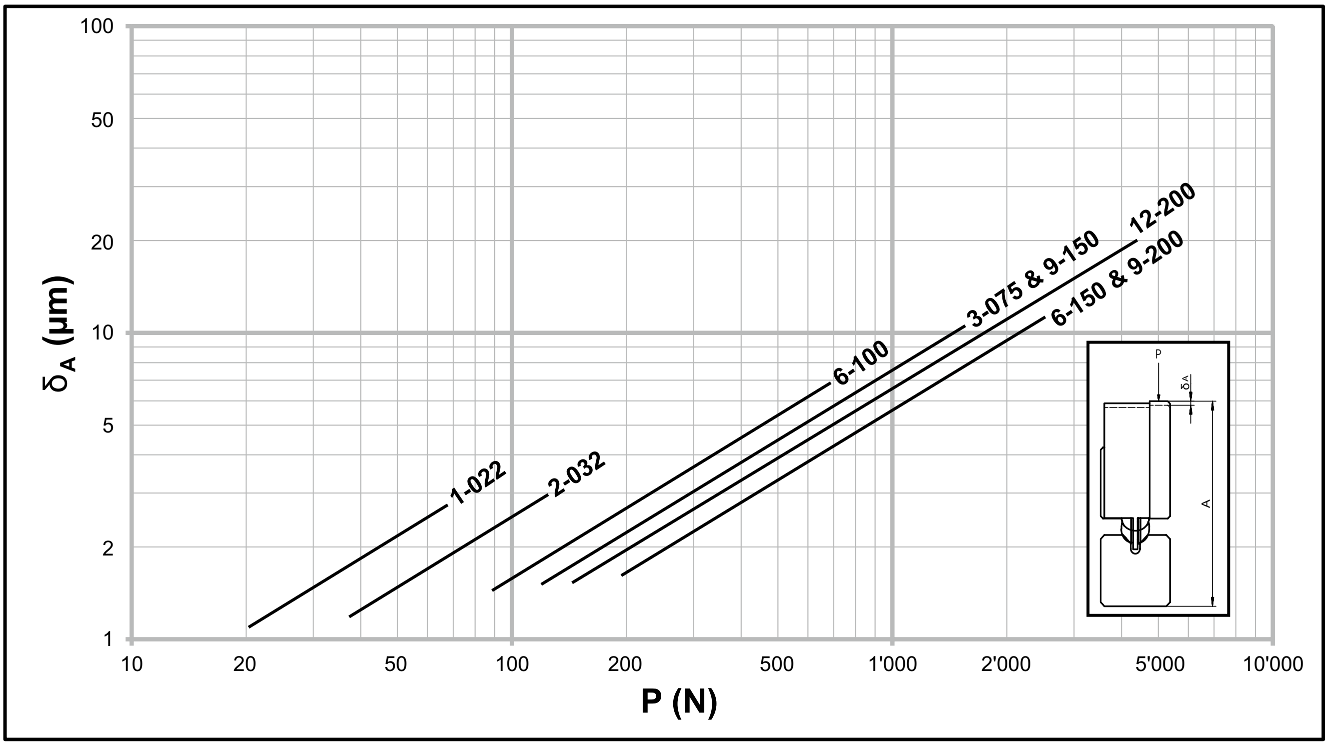


The elastic deformation of the linear guideways of types N/O and M/V upon use with the following types of cages

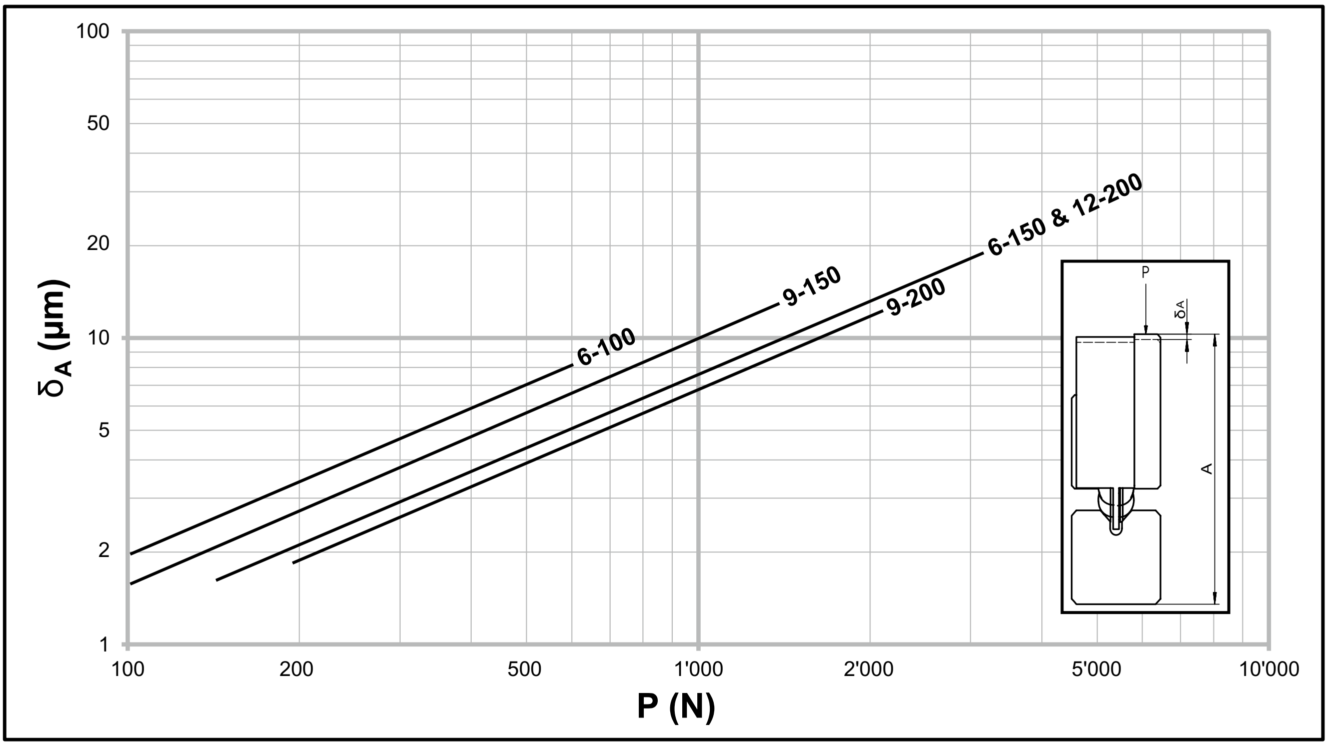


12.6 Elastic deformation and rigidity of recirculating units

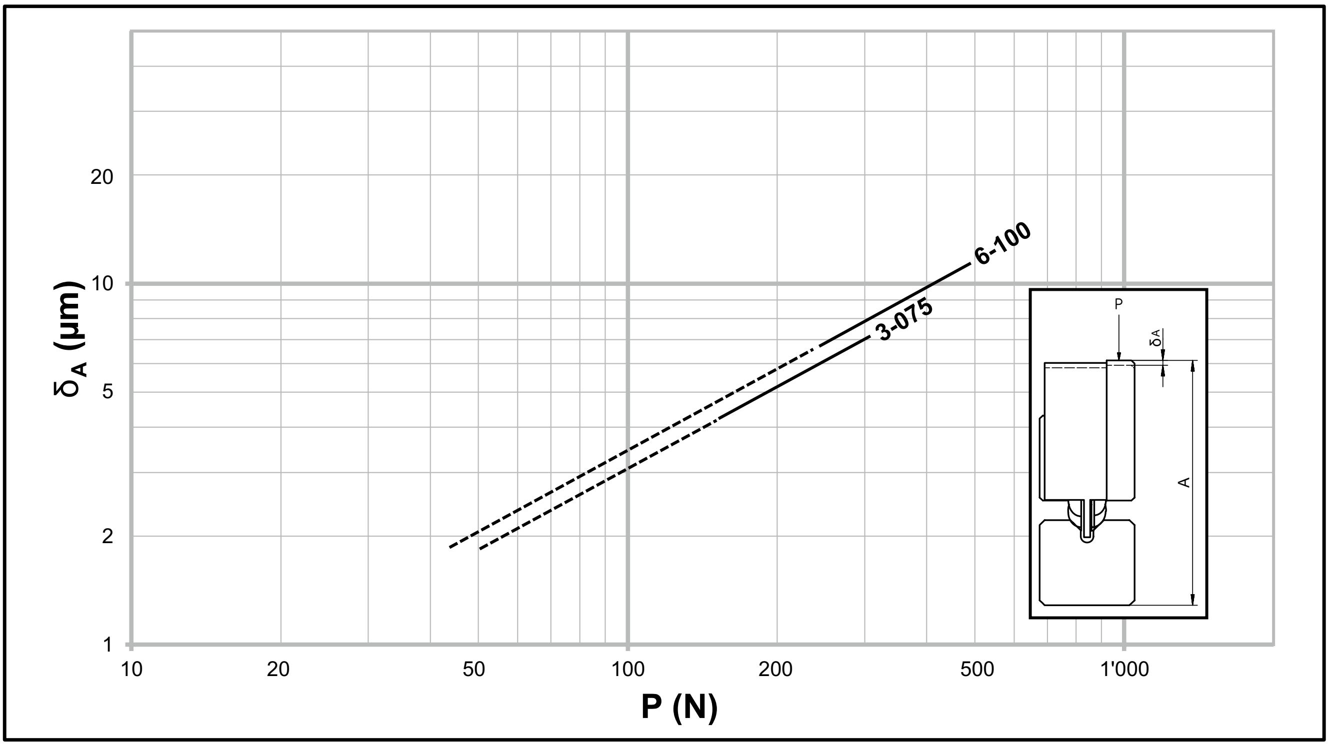
The elastic deformation of the recirculating unit of type SK in connection with linear guideways type R or RD.



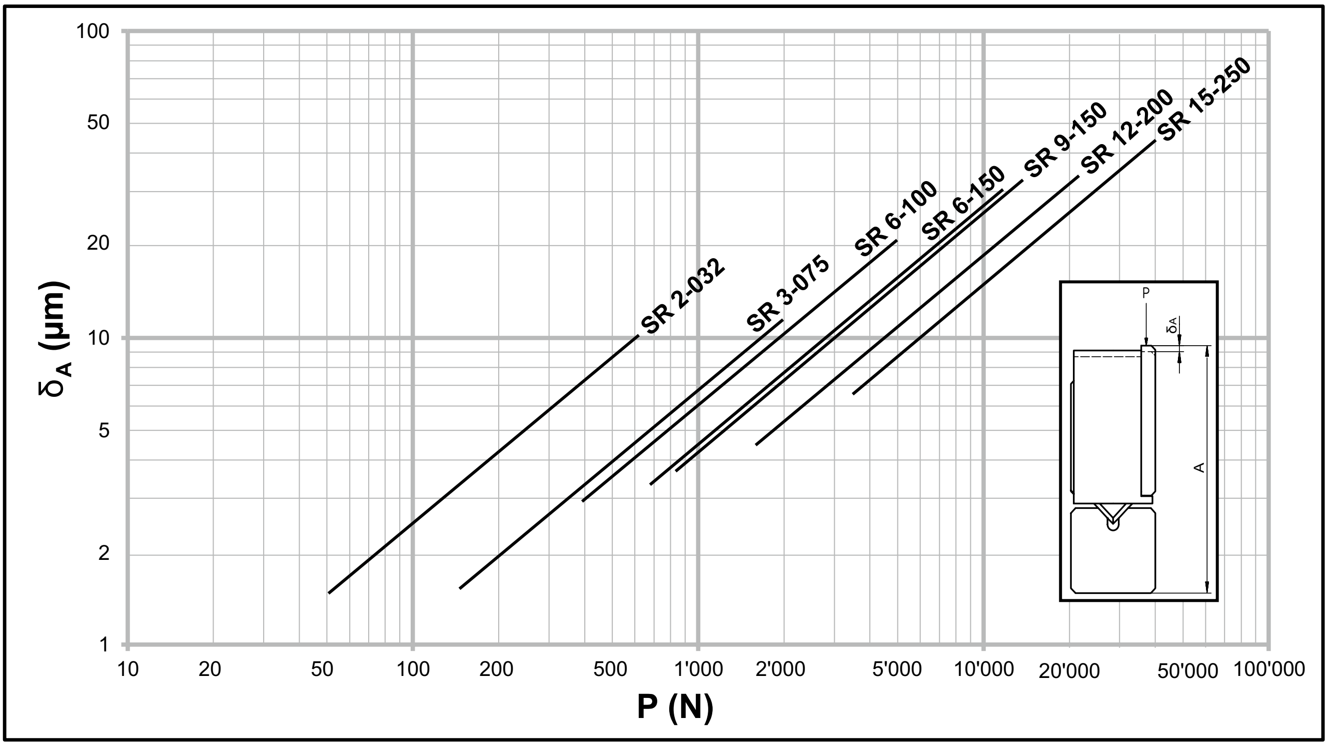
The elastic deformation of the recirculating unit of type SKD in connection with linear guideways type R or RD.



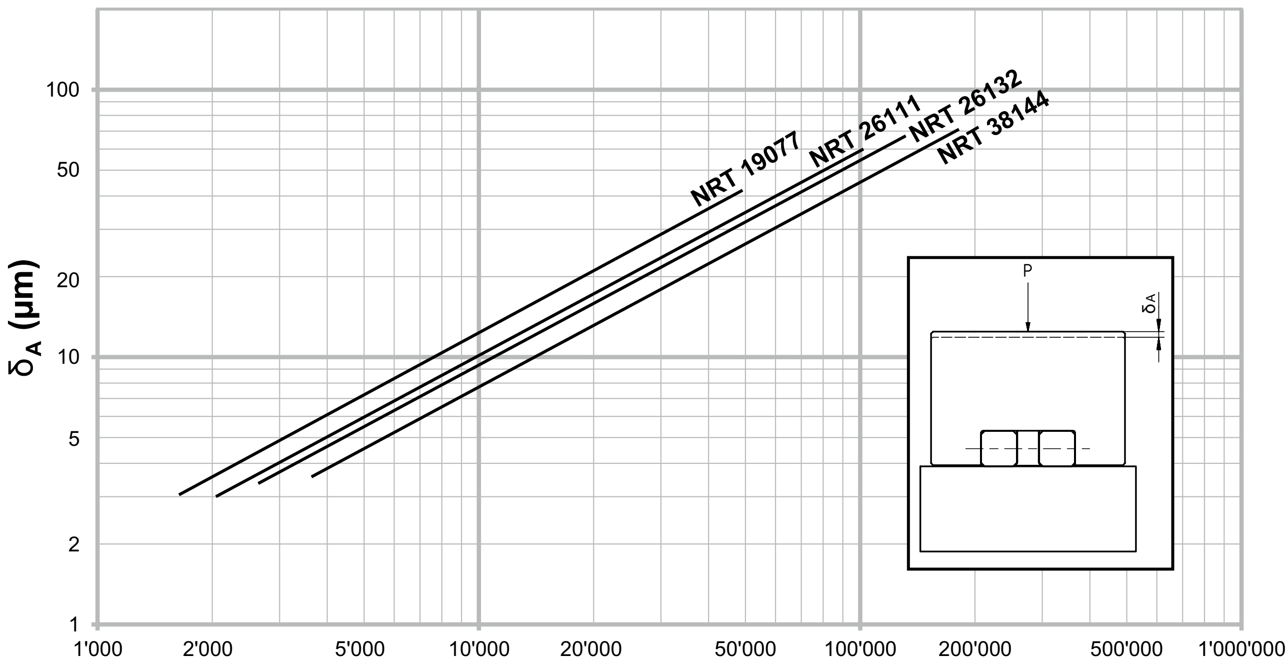
The elastic deformation of the recirculating unit of type SKC in connection with linear guideways type R or RD The total length of the straight lines applies for lubricated recirculating units, the dotted straight line for unlubricated ones.



The elastic deformation of the recirculating unit of type SR in connection with linear guideways type R or RD.



The elastic deformation of the recirculating unit type NRT.



in connection with hardened tracks

13 Construction and installation guidelines

13.1 The connecting structure and its influence on service life

Linear guideways are high-precision components. The requirements for theconnecting structure are also high to ensure the accuracy of the guideways are maximized.

The quality of the reference and supporting surfaces as well as the rigidity of the connecting structure must meet the most stringent requirements. If this is not the case, smoothness, precision and service life of the guideway will be significantly affected.

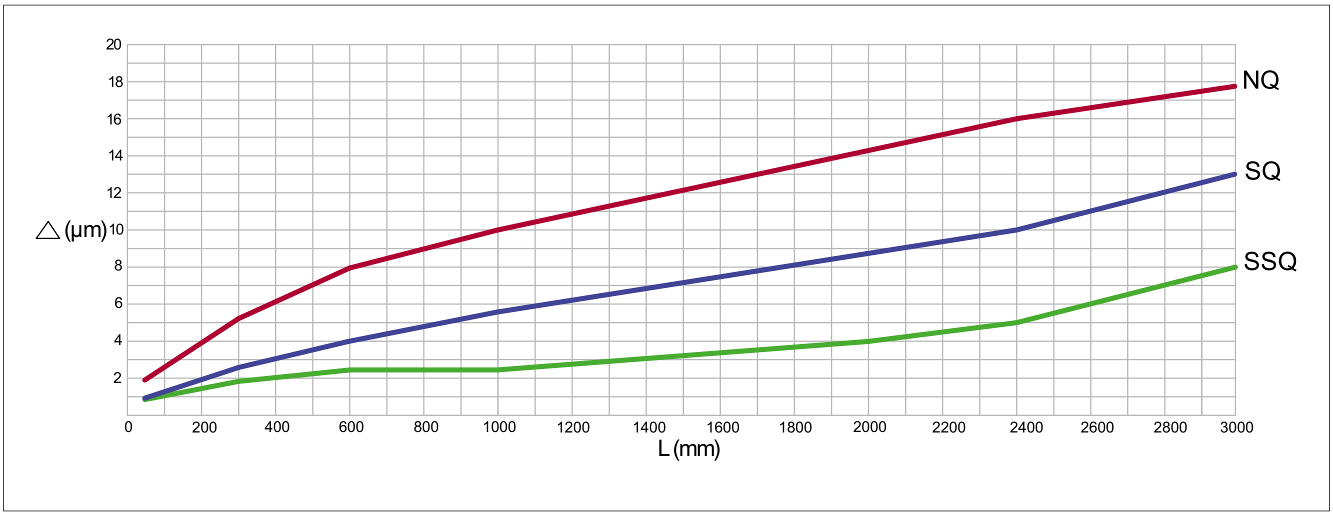
To exploit the full potential of the linear guideways, assembly on a rigid and ground substrate is recommended. Connecting structures made of light metal are only suitable in certain instances - due to their lower rigidity and limited machining accuracy.

13.2 Configuration of the connecting structure

Parallelism of the reference and locating surfaces

They must be compatible with those of the linear guideway (also applies when using linear guideways with recirculating units):

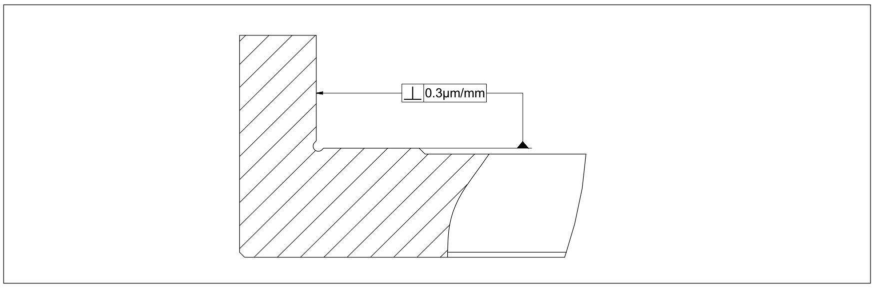
NQ Normal quality
SQ Special quality
SSQ Super special quality



Surface quality

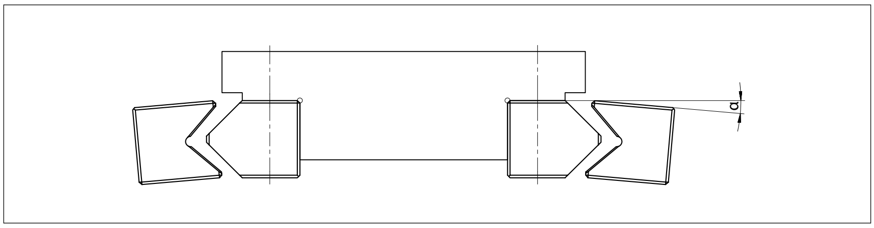
The accuracy of the application critically determines the required surface quality of the reference and locating surfaces. For high-precision applications they must demonstrate a maximum Ra value of 0.4. An Ra value of 1.6 may not be exceeded for standard applications.

Angular error



The angular errors for the supporting and locating surface should not exceed 0.3 µm/mm.

Height offset for linear guideways

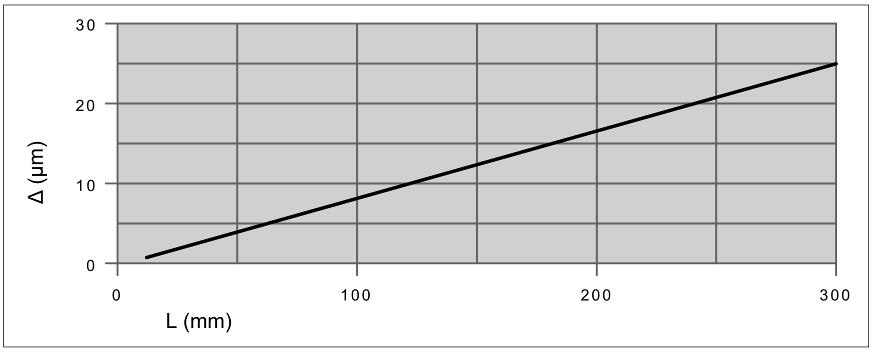


The angular errors resulting from height offset and/or elastic deformations may not exceed the following values:

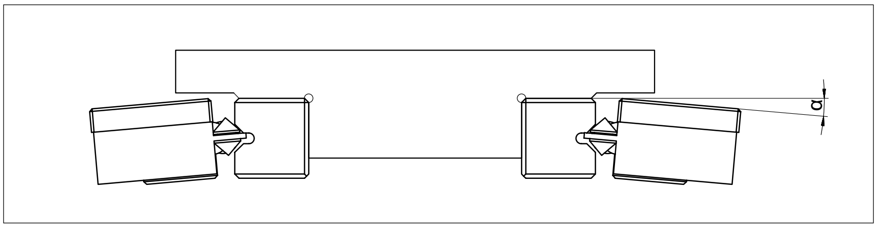
Balls or rollers:	0.3 µm/mm
Needles	0.1 µm/mm

Parallelism of the supporting and locating surfaces in the case of the recirculating unit

The parallelism of the supporting and locating surfaces in relation to the mating track can be derived from the diagram below:

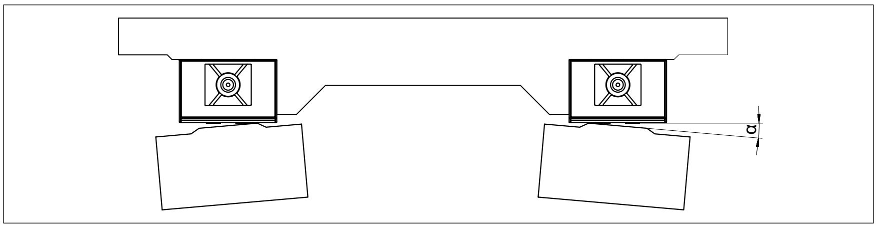


Height offset for recirculating units



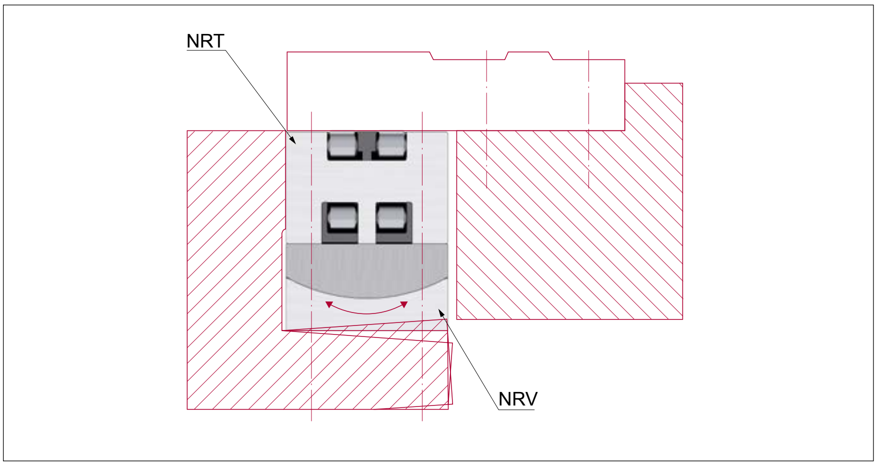
The angular errors results from height offset and/or elastic deformations may not exceed the following values:

For types SK, SKD and SKC	3.0 µm/mm
For types SR	0.3 µm/mm



For types NRT	0.3 µm/mm

Combination of recirculating unit NRT with preload wedge NRV



So that straight run-off is guaranteed, the recirculating unit NRT must always be oriented against the locating surface. The preload wedge NRV should be aligned opposite the recirculating unit and compensates for angular errors.

13.3 Installation methods

SCHNEEBERGER linear guideways are not designed to be load-bearing structural components, but as guideway components.

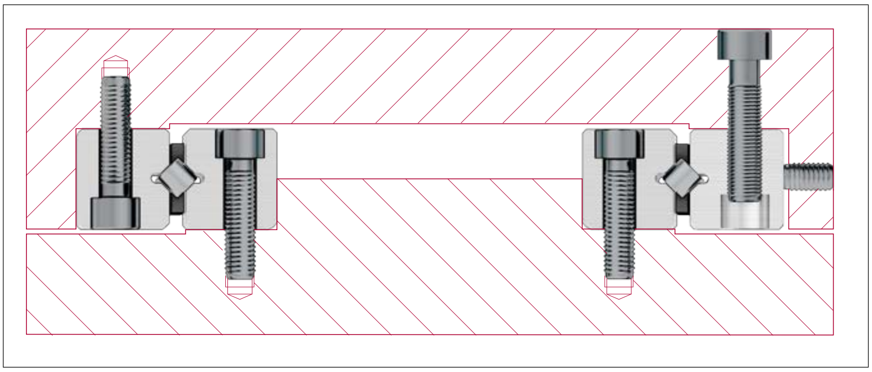
Horizontal installation indicates direction of movement runs horizontally. Likewise, vertical installation indicates direction of movement deviates from the horizontal plane.

Enclosed configuration

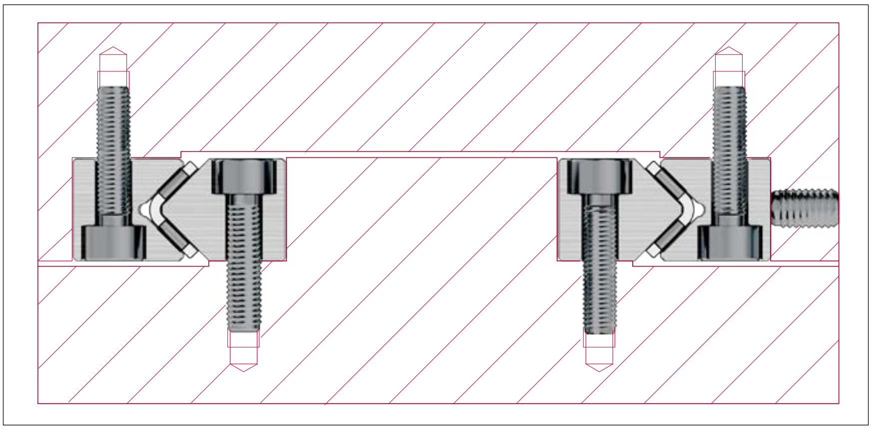
The enclosed configuration is a fixed/fixed bearing. It can be loaded by moments and forces in any direction. Rigidity and running accuracy can be influenced by a change in the preload.

The advantages and characteristics of an enclosed configuration:
- Supports any operation position, load direction and moment load
- Supports a small guideway base
- Must be preloaded. Consequently, rigidity and accuracy are increased.

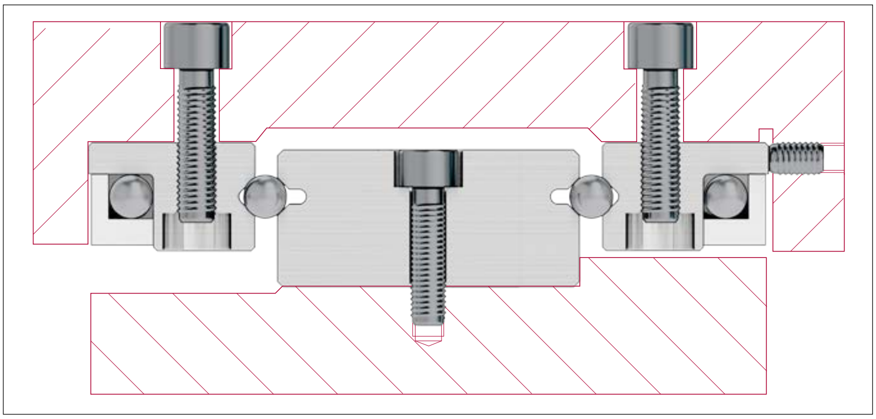
An example involving linear guideways of type R, RN or RNG



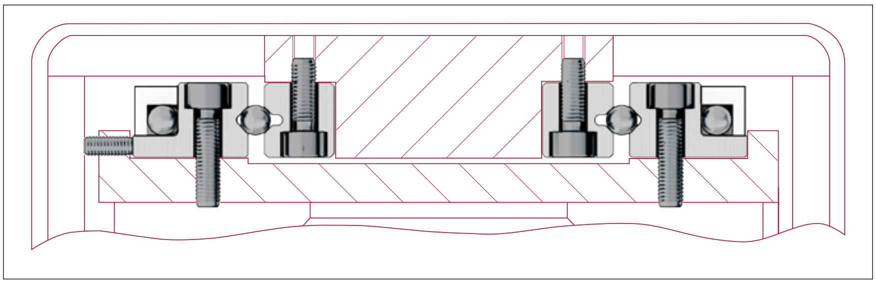
An example involving linear guideways of type N/O or M/V



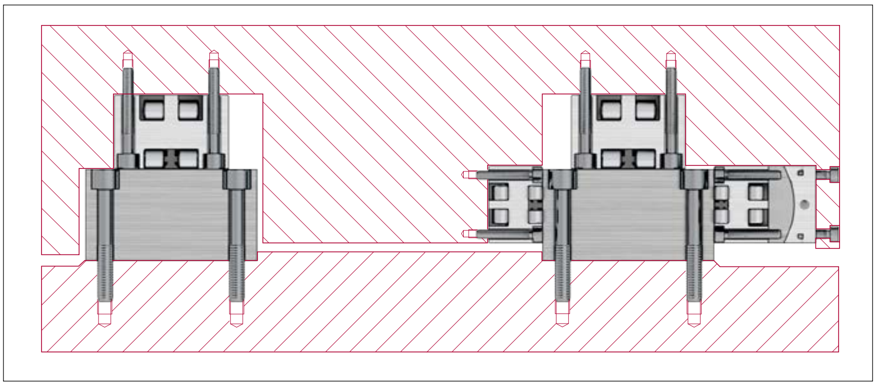
Example with recirculating units of type SK, SKD, SKC or SR combined with the double V-shaped guide RD



Example involving recirculating unit of type SK and linear guideways of type R



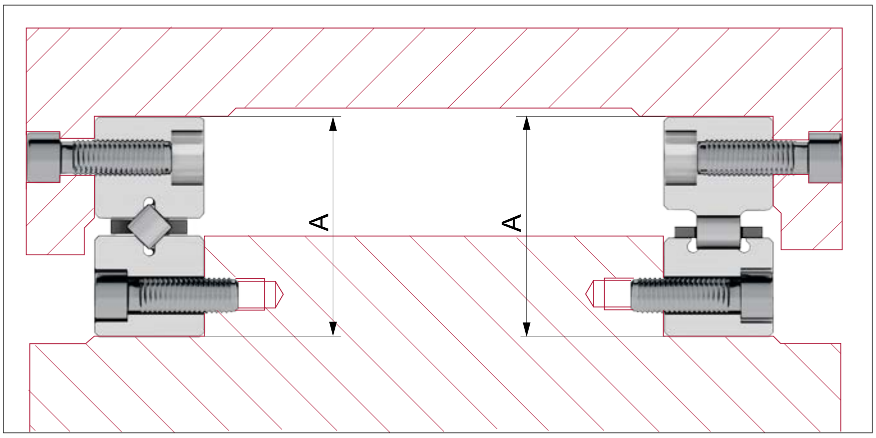
Example involving recirculating unit of type NRT and surface guideways of type E



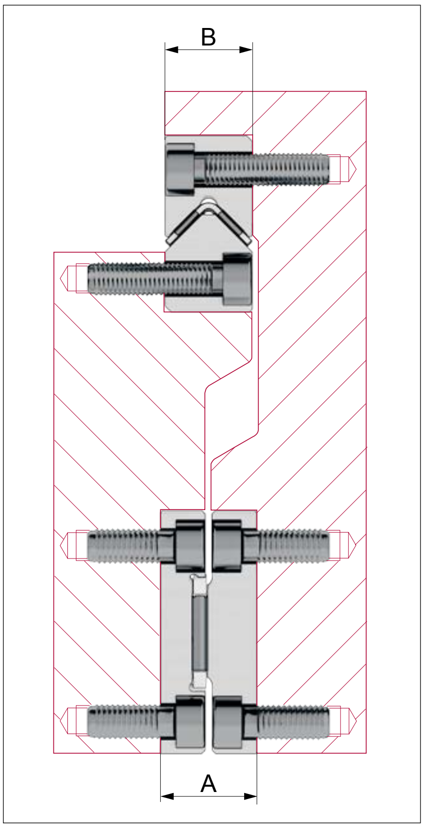
Open configuration

The open configuration is a fixed/loose bearing offering the following advantages and characteristics:
- Is mainly used when the load acts centrally and vertically on to the guideway plane and no deformations may occur by tensioning the surrounding structure.
- Thermal lateral variations are evened out
- Large bearing spans can easily be bridged
- Requires a large guideway base
- Very installation-friendly as the machine component can easily be seated and/or lifted off

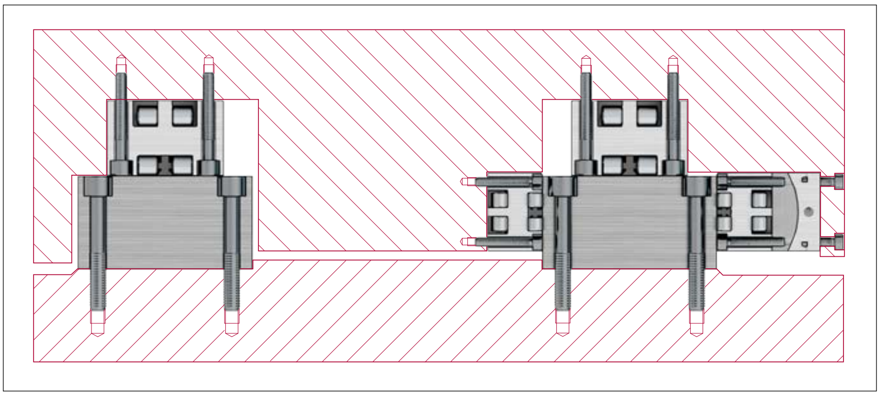
Example involving linear guideways of type R, RN or RNG combined with a surface guideway of type W/Z. In the case of open configurations, the height A for both pairs of guideways must be height-matched (see chapter 7.5).



Example of a suspended linear guideway of type N/O or M/V combined with a surface guideway of type L/M. The dimensions A and B must be height-matched.

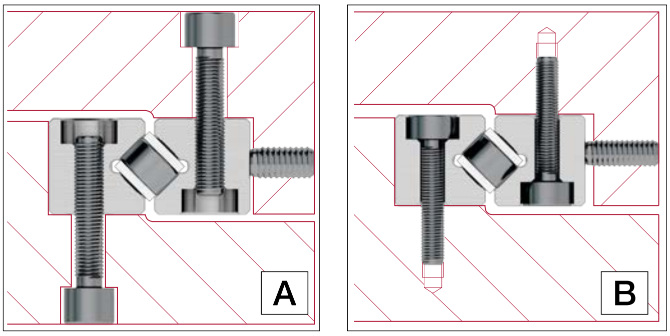


Example involving recirculating unit of type NRT and surface guideways of type E. The vertical load is born by height-matched NRT



13.4 Fastening

Linear guideways



Fastening variants

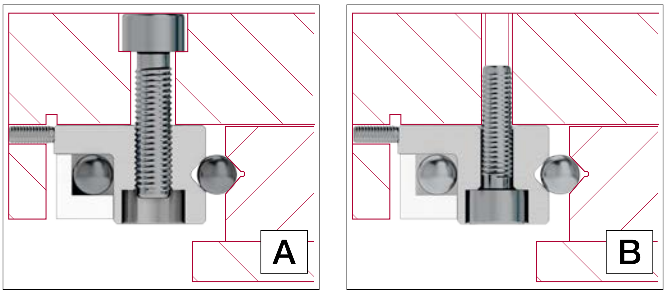
The SCHNEEBERGER linear guideways and recirculating units can be fastened to the connecting structure in two different ways:

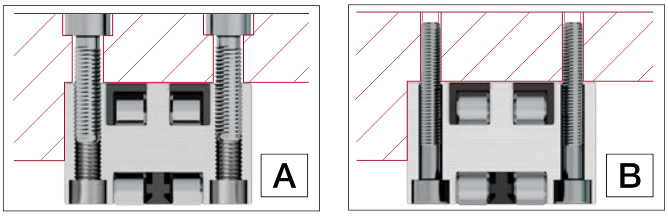
A The use of the tapped boreholes
B The use of through holes

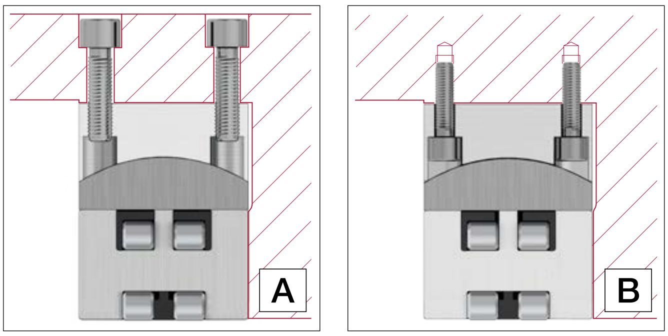
Method A is preferred because a powerful fastening is possible based on the screw size

Method B provides added flexibility combined with the fastening screws with a thin shaft (see chapter 5).

Recirculating units







13.5 Torque settings for fastening screws

The recommended torque settings can be found in the table. These values apply in respect of oiled screws.

By using greases containing MoS^2, the required torque can drop to half of the values set out below.

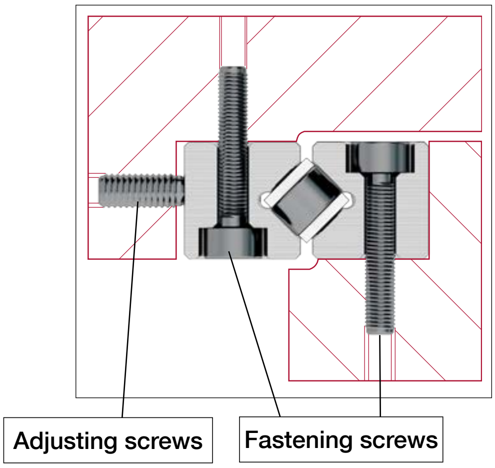
Strength grade 8.8

Sizes	Max. tightening torque in Ncm*	
	Fastening screws DIN 912	Fastening screws with thin shaft, type GD or GDN
M 2	35	–
M 2.5	73	54
M 3	128	94
M 4	290	221
M 5	575	463
M 6	990	762
M 8	2400	1838
M 10	4800	3840
M 12	8300	6579
M 14	13200	10631
M 16	20000	–

* Tightening torques apply for materials with a tensile strength of > 360N/mm^2

13 Construction and installation guidelines

13.6 Preload



The size of the preload is guided by the intended use of the guideways. A high preload …
… increases rigidity of the guideway and guarantees zero-backlash
… reduces moment loads, maximum loads on the rolling element
… increases displacement resistance
… reduces the service life

A positive effect of preload is achieved with 5 % - 20 % of the permissible load C.

General approach

The preload can be consistently set using a torque wrench. In so doing the friction between screw and tapped fixing hole must be taken into account (to be determined by means of tests).

When using **wedge adjusters or adjusting plates**, the ideal preload must be determined based on the elastic total deformation δ_A (see chapter 12.5) and the deformation of the connecting structure.

When setting an R-guideway with **cage type EE**, the cage must first be slightly compressed before the rollers are applied.

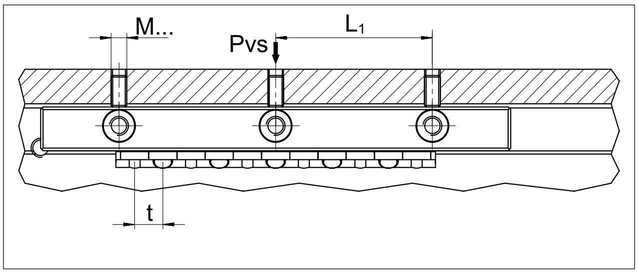
As mentioned above, the preload increases the rigidity of the guideway. A high preload, however, requires a stable connecting structure. Otherwise unwanted edge loads occur to rollers and needles as a result of angular errors, which in turn has a negative impact on load carrying capacity.

Procedure for linear guideways

A guideway is normally set with zero-backlash using **adjusting screws**. A zero-backlash, uniform sequence is only achieved when advancing exclusively takes place where the cage with the rolling elements is located (see also chapter 13.9).

At least one **adjusting screw** must be provided per **fastening screw**, the thread size of which should match the **fastening screw**. In the case of **overrunning cages**, the shorter rail should preferably be advanced.

Example calculation for the infeed force per adjusting screw (Pvs) of their tightening torque (Mds)



Required information per calculation:

- Linear guide type R 3	L_1 = 25 mm
- Roller cage type AC 3	t = 5 mm
	C = 130 N
- Diameter of the adjusting screw	= M4
- Factor f (for rollers = 1; for balls / needles = 2)	f = 1
- Preload p (2 % to 20 % of C)	p = 10 %
- Factor a in cm (as per the following table)	

Thread	Factor a
M2	0.0238
M2.5	0.0294
M3	0.035
M4	0.0469
M5	0.058
M6	0.0699
M8	0.0926
M10	0.1152
M12	0.1378
M14	0.1591
M16	0.1811

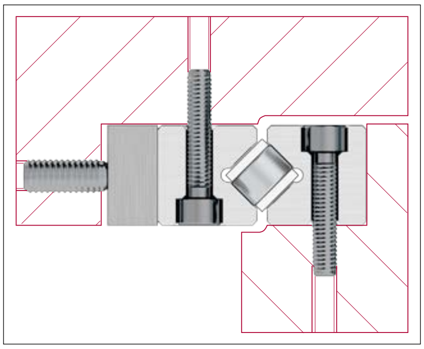
Calculation of the infeed force per adjusting screw Pvs

$$Pvs = L_1 / t \cdot C \cdot p / 100 \cdot f$$
$$= 25 / 5 \cdot 130 \cdot 10 / 100 \cdot 1 = 65 \text{ N}$$

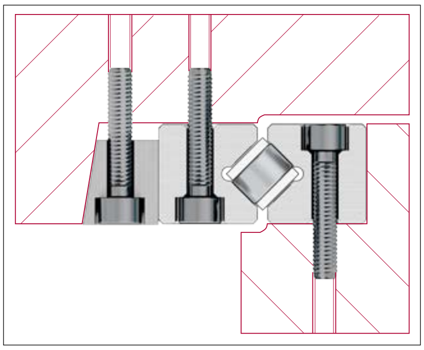
Calculation of tightening torque Mds

$$Mds = Pvs \cdot a$$
$$= 65 \cdot 0.0469 = 3.05 \text{ Ncm}$$

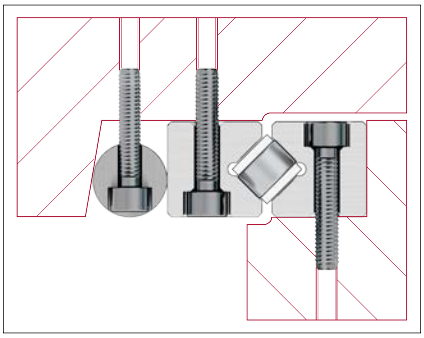
Other technical possibilities for preloading linear guideways include:



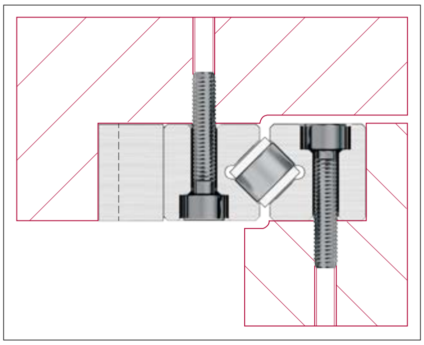
Setting using an **adjusting strip**



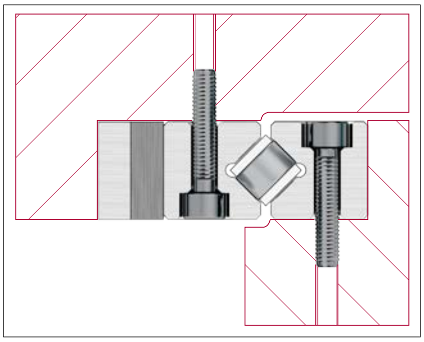
Setting using a **wedge adjuster**



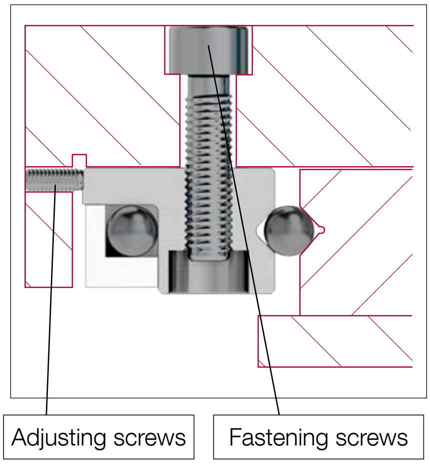
Setting using a **cylinder adjuster**



Setting using a **longitudinal wedge**



Setting using a **double longitudinal wedge**



Procedure when preloading recirculating units (SK, SKD, SKC and SR)

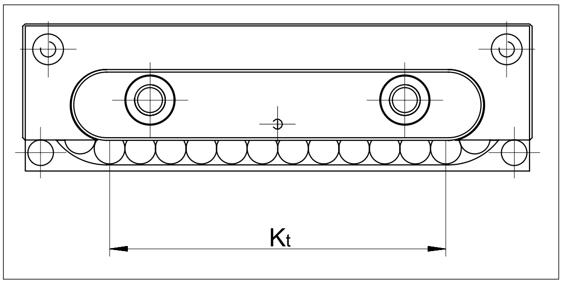
A recirculating unit is normally set with zero-backlash using **adjusting screws**. At least one adjusting screw must be provided per **fastening screw**, the thread size of which should match the fastening screw.

Example calculation for the infeed force per adjusting screw (Pvs) of their tightening torque (Mds)

Required information per calculation:

- Recirculating unit SK 6-100 — C = 715 N
- Diameter of the adjusting screw — = M4
- Number of adjusting screws N — = 2
- Factor f ("1" for roller, "2" for balls) — = 2
- Preload p (5 % to 20 % of C) — = 10%
- Factor a in cm — as per the following table

Thread	Factor a
M2	0.0238
M2.5	0.0294
M3	0.035
M4	0.0469
M5	0.058
M6	0.0699
M8	0.0926
M10	0.1152
M12	0.1378
M14	0.1591
M16	0.1811



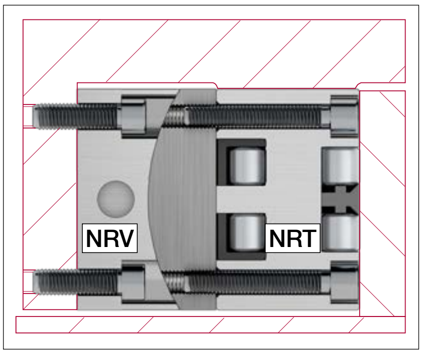
Calculation of the infeed force per adjusting screw Pvs

$$Pvs = C \;/ N \cdot p / 100 \cdot f$$
$$= 715/2 \cdot 10/100 \cdot 2 = 71.5\text{ N}$$

Calculation of tightening torque Mds

$$Mds = Pvs \cdot a$$
$$= 71.5 \cdot 0.0469 = 3.35\text{ Ncm}$$

Its advance must always remain within the load-bearing length K_t!

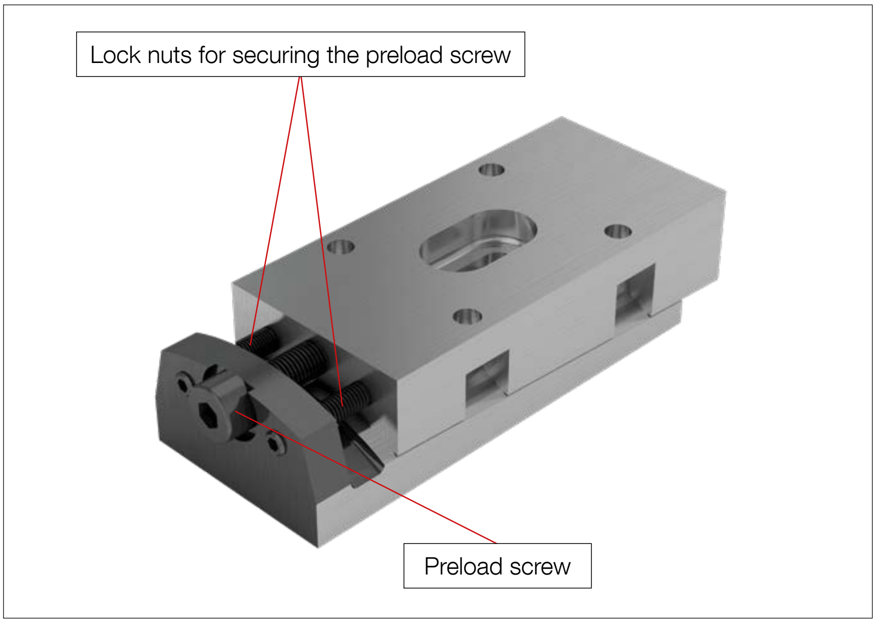


Procedure for recirculating unit NRT with preload wedge type NRV

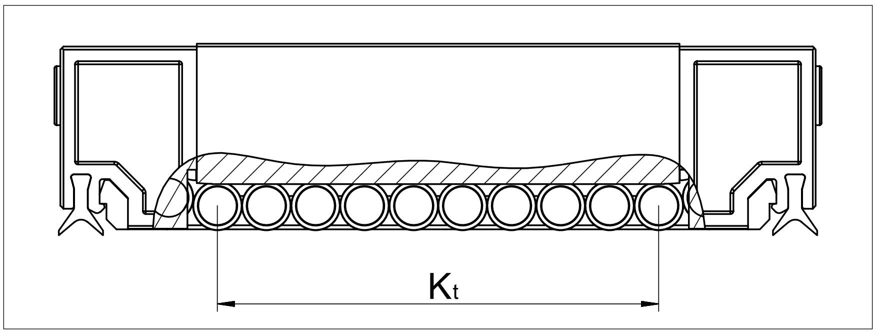
For preload using preload wedge NRV the following infeed values apply:

Type	Size	Max adjustment range in terms of height (mm)	Height difference per revolution of the preload screw A
NRV	19077	0.35	0.0350
	26111	0.40	0.0625
	26132	0.40	0.0625
	38144	0.40	0.0750

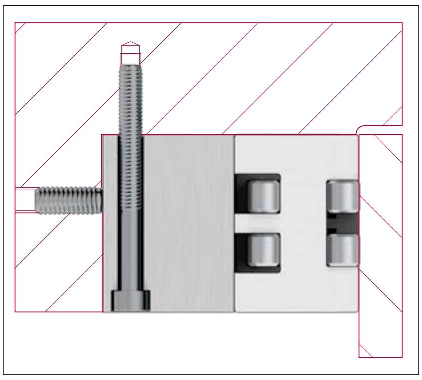
After successfully setting the preload, always tighten the two lock nuts alternately and use the wrench applying the same amount of torque!



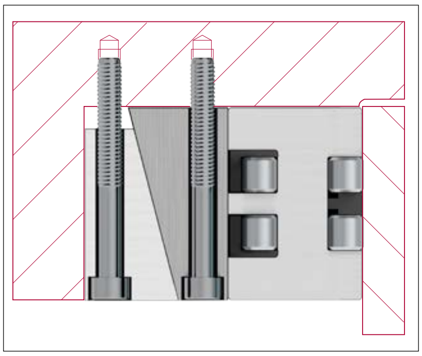
If preloading takes place without preload wedge NRV it is important to ensure that the advance must always remain within the load-bearing length K_t.



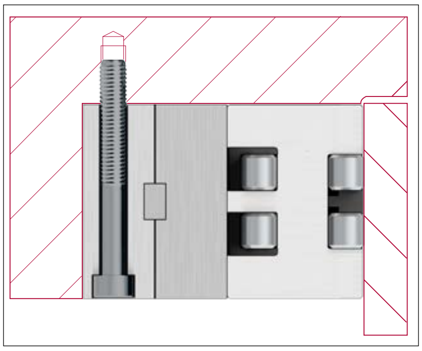
Other technical possibilities for preloading the NRT include:



Setting using an **intermediate plate**

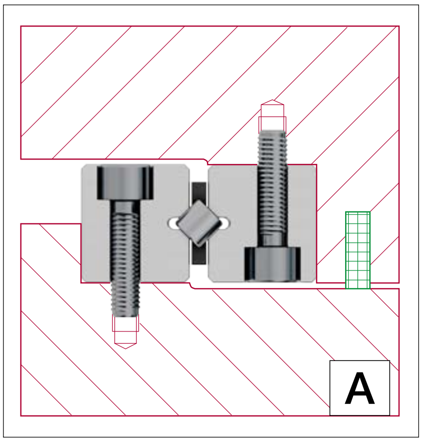


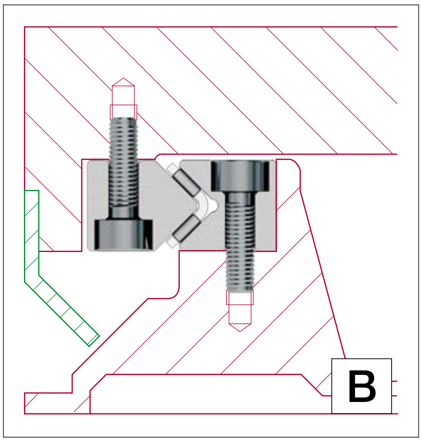
Setting using a **wedge adjuster**

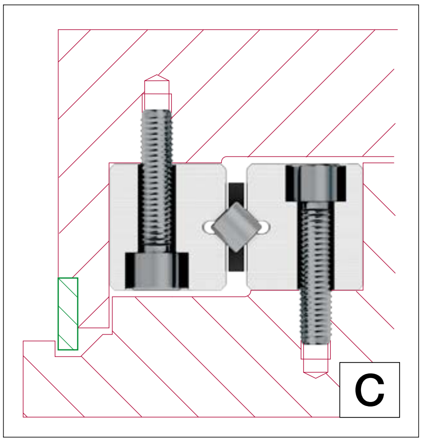


Setting using a **double longitudinal wedge**

13.7 Sealing and covers







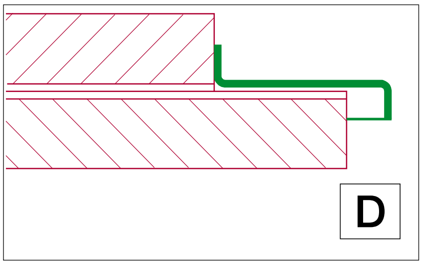
The method of sealing or covering is significant for the smooth operation and service life of the guideways.

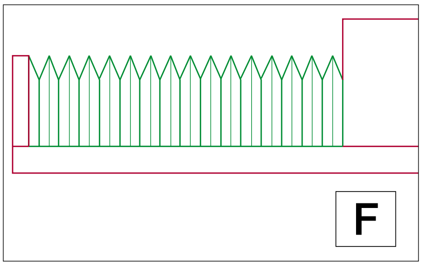
Where there is only a small amount of dirt, wipers are sufficient to keep the tracks clean. Their braking effect can generally remain unattended. We offer a variety of standard wipers, which are described in detail in the respective product specifications.

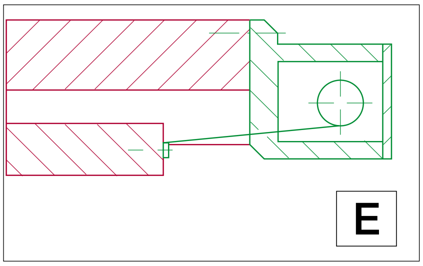
Covers are used when there is some danger of harmful contamination of the guideway. While wipers only push the dirt off the running surfaces in the area of their movement, covers provide the opportunity of also keeping penetrating dirt away at the sides.

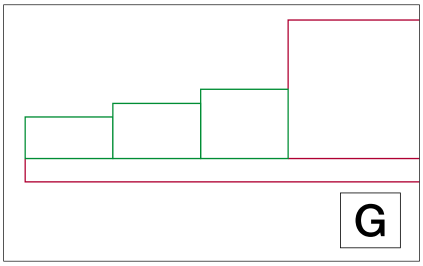
Some design options are listed below:

A = Wiper sideways
B = Diverting swarf and coolant away using a cover
C = Labyrinth seals offer an effective and economically viable protection
D = Simple metal cover
E = Roll-up cover
F = Bellows above or below
G = Telescopic cover









13.8 Lubrication

Lubrication is a design element and must therefore be defined during the development phase of a machine or application. If the lubrication is only selected after design and construction is complete, based on experience this is likely to lead to considerable difficulties. A carefully thought out lubrication concept is therefore a sign of a state-of-the-art and well devised design.

Parameters to be taken into account in selecting the lubricant, amongst others, include:

– Operating conditions	(speed, accelerations, stroke, load, installation orientation)
– External influences	(temperature, aggressive media or radiation, dirt accumulating, moisture)
– Subsequent lubrication	(period of time, quantity, compatibility with other lubricants)
– Compatibility	(with corrosion protection, with integrated materials such as plastic cages)
– Tracks	(geometry, surface roughness, hardness, material, coating, wettability)

Technical and economic considerations determine the lubricant and process to be used. Generally lithium-soap-based roller bearing grease are used to lubricate (alloyed greases KP2K in accordance with DIN 51502 or DIN 51825). Oil dispensers or occasional oiling via oil nipples fully meet the demands of the guideways. For minimal roller frictional resistance lubrication with mineral-oil-based oils is recommended (CLP or HLP in viscosities of ISO VG 15 to 100 in accordance with DIN 51519).

The lubricants are normally applied through the spacing between the linear guideways and the recirculating units or through the lubrication holes in some instances available as standard or lube nipples in the recirculating units. If this is not supported by the design (e.g. in the case of vertical installation), on request linear guideways with lube holes can also be supplied. Particularly advantageous are oil mist lubrication methods, which help to prevent dirt accumulating on the guideways with their slight excess pressure. Their acceptability is greatly limited, however, due to their environmental impact. Cutting-oils or water soluble coolants are to be kept away from the guideways, however, because they dilute or wash away the available lubricant. In addition, coolants tend to stick when drying out. Lubricants with solid additives are inappropriate.

Subsequent lubrication intervals depend on the aforementioned operating conditions and external influences and cannot be therefore be calculated. That is why the lubrication point must be observed over a lengthy period of time.

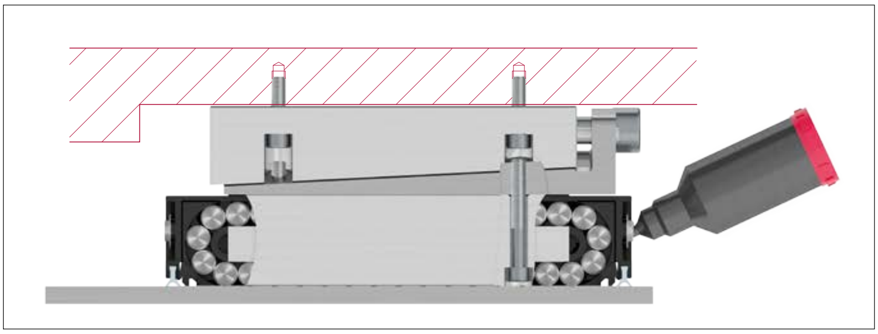
Values based on historical experience show that with normal use subsequent lubrication of up to 2 to 5 times is sufficient, spread over the calculated service life.

Lubrication of the recirculating unit NRT

There are three ways of lubricating the NRT

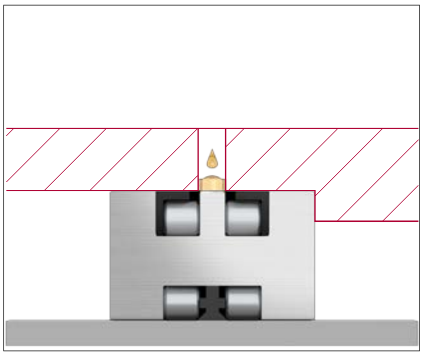
Variant A: **Lube nipple on each end face**
Variant B: **Lube opening on the top**
Variant C: **Optional connection for a centralised lubricating system**

Variant A: Lubrication by means of the lube nipple

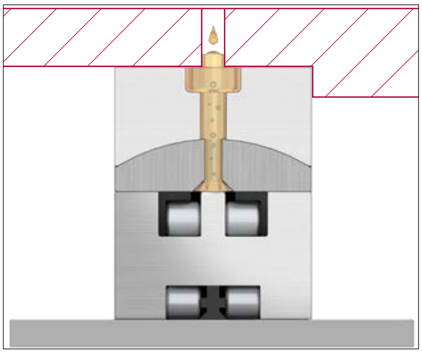


Variants B:

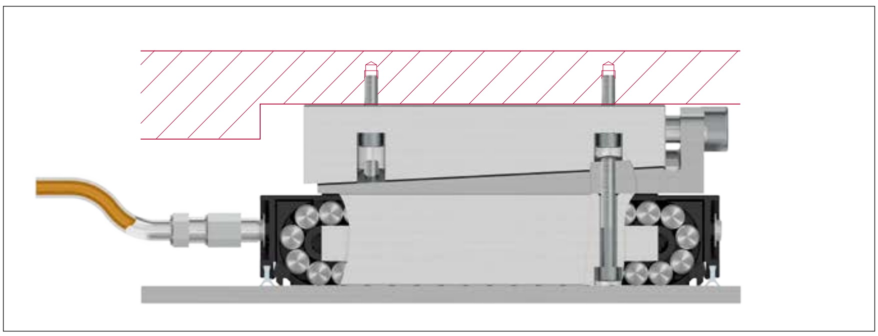
Oil delivery through the lube opening on the top



Oil delivery through the lube opening on the top through the preload wedge NRV



Variant C: Centralized lubricating system (option ZS)

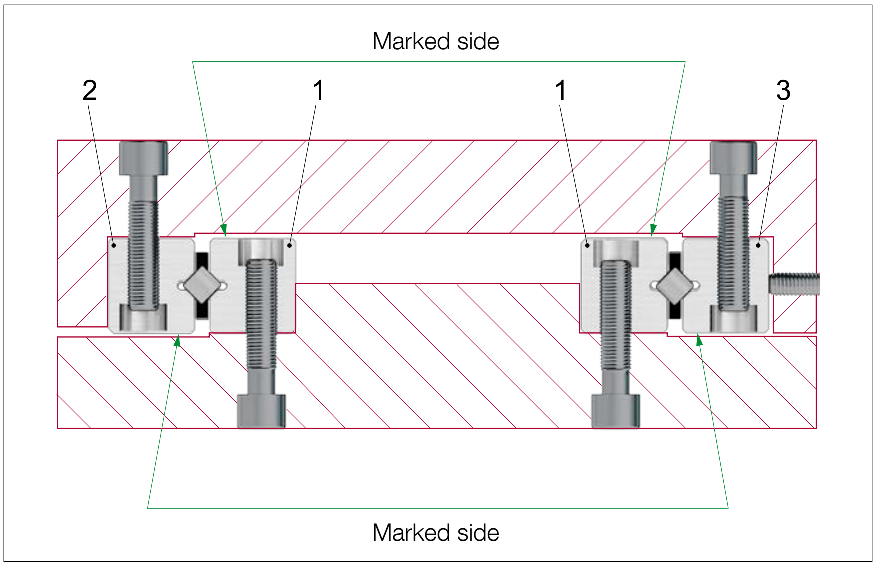


13.9 Transport, handling and storage

Linear guideways and recirculating units are high-precision components and should therefore be handled with care. They should always be transported in their original packaging to protect them from damage and be stored at room temperature and in a dry environment.

Improper handling of the guideways can lead to preliminary damage and thus to premature failure. That is why their assembly may only be undertaken by expert professional staff.

13.10 Installation guidelines



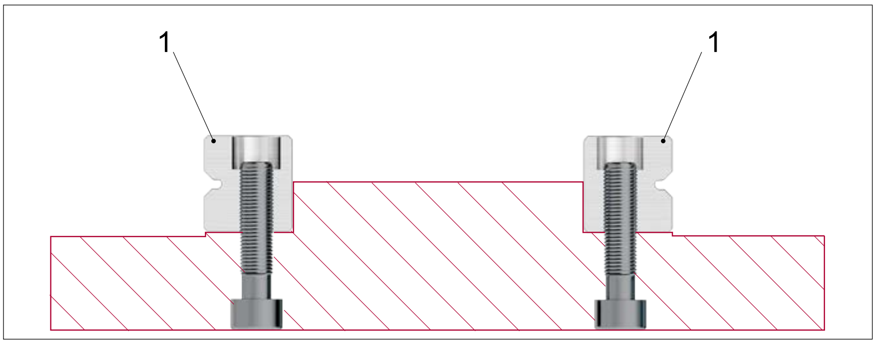
Linear guideways

With careful, clean preparation and a step by step approach, by adopting a rational procedure you will achieve a perfect guide system.

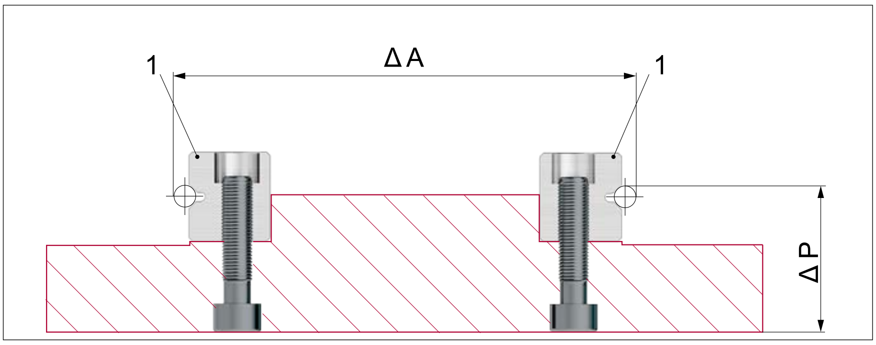
The following installation instructions applies by analogy for all types of SCHNEEBERGER linear guideways.

- To guarantee a perfect support for the guide rails, any remaining burrs or ridges are to be removed with a fine whetstone
- Before installation, the linear guideways and supporting surfaced should be cleaned. By means of a subsequent light lubrication they will be protected from any consequential damage
  Tip for long or multi-part guide rails:
  Due to the bore hole tolerances of the rails, the fastening holes in the supporting surfaces should be drilled according to the holes in the linear guideways. By using fastening screws with a thin shaft differences in hole spacings can also be evened out (see chapter 5).
- The marked side of the guide rail may not be used as a supporting surface!

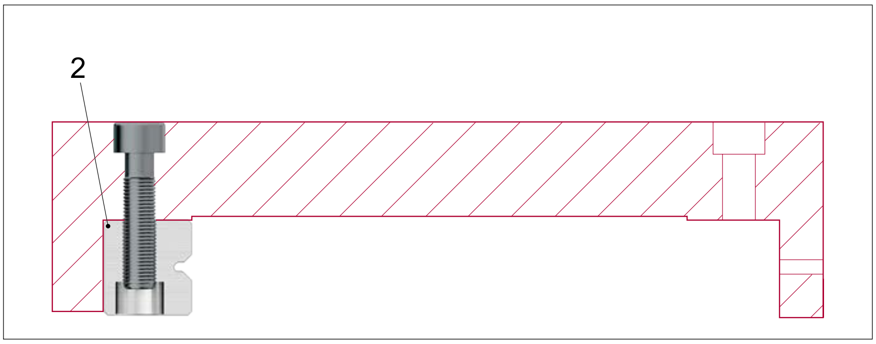
- The fixed pair of linear guideways (1) is pressed against the supports using an appropriate clamping element and the fastening screws are tightened (use a torque wrench! For tightening torque see chapter 13.5.)



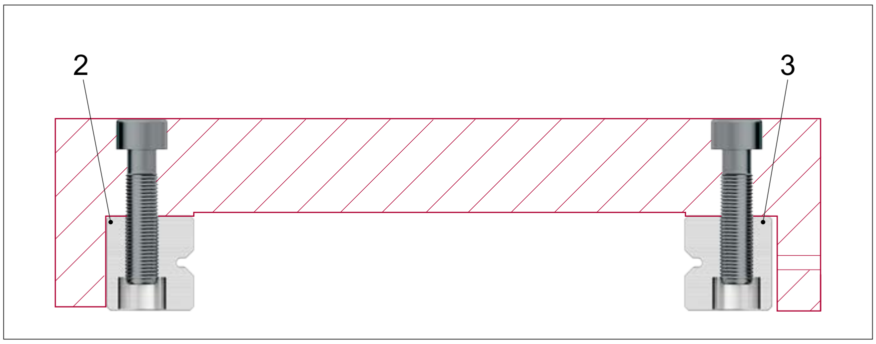
- Check parallelism ΔA and ΔP. The parallelisms measured must fall within the tolerances of the linear guideway (see chapter 7.1)



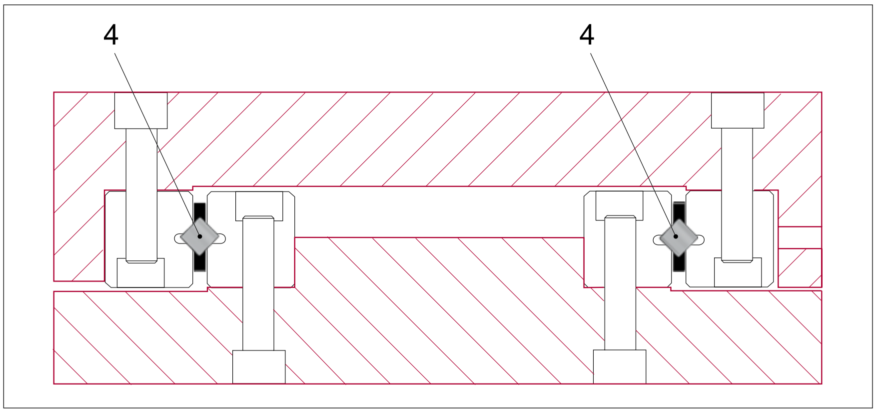
- Install the fixed rail (2) of the opposing pair

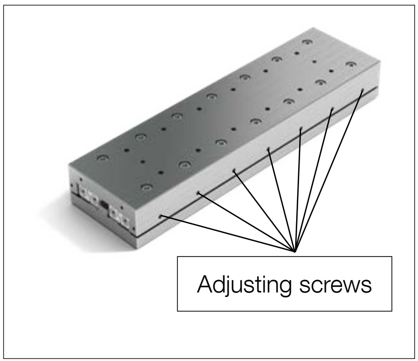


- Install the rail (3) and in so doing only lightly tighten the fastening screws
- Lubricating (see chapter 13.8)



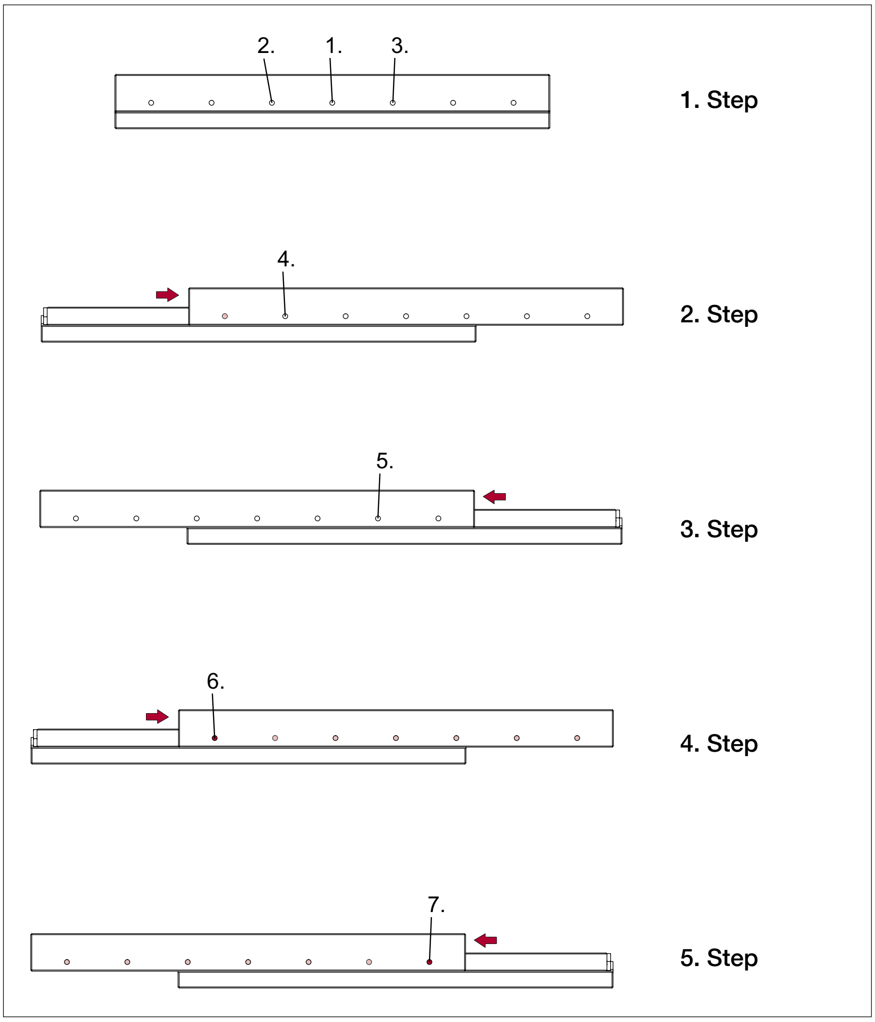
- Insert and center the cages (4). After that the linear bearings must be preloaded (please refer to the following page)



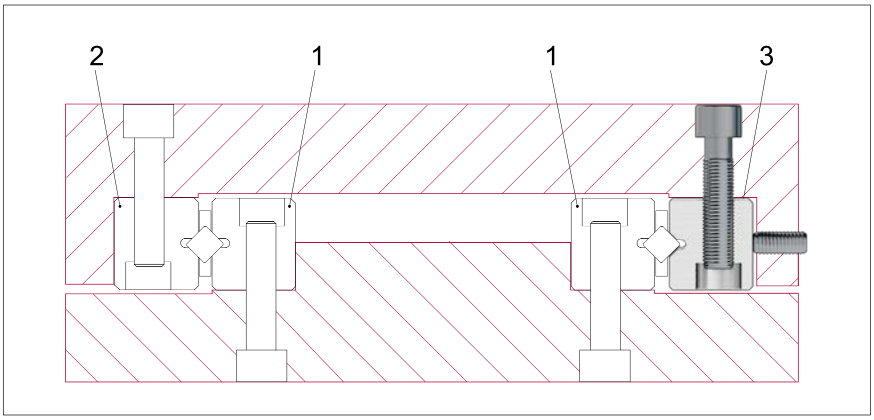


- Set and/or preload the linear guideway with zero-backlash (see chapter 13.5)

Application of the preload using the adjusting screws should be carried out from the centre of the rail outwards using the following steps (the sequence can be worked out from the figures):

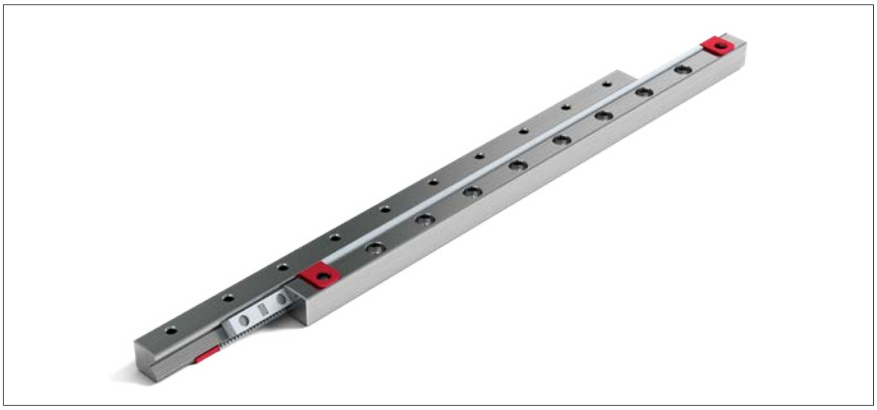


- Tighten the fastening screws for the rail (3)
- Install the end pieces



14 Order descriptions

Examples for linear guideways



Example 1 - set consists of	Quantity	Type and size	Length in mm	Options
Guide rails	4	RNG 6	- 300	-RF-SSQ-KS
Cage	2	KBS 6 x 20*		-RF

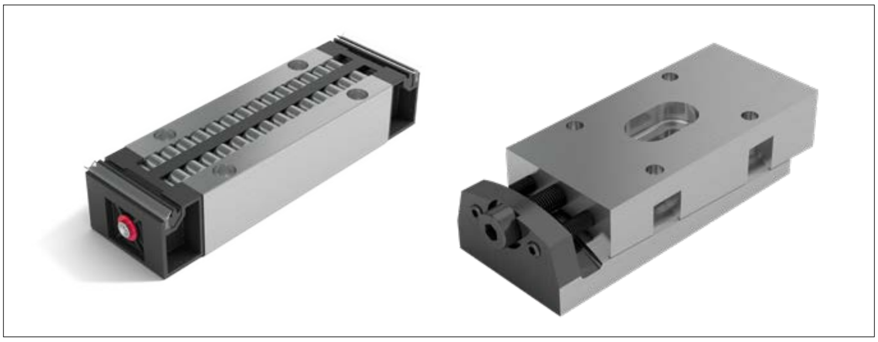
Example 2 - set consists of	Quantity	Type and size	Length in mm	Options
Guide rails	2	R 9	- 800	
Guide rails	2	R 9	- 600	-EG
Cage	2	AC 9 x 22*		
End pieces	8	GC 9		

* corresponds to the number of rolling elements
Note: In the case of cage types HW and SHW the cage length must be indicated in mm! (e.g. SHW 20 x 155 mm)

Order example 1
Set RNG 6-300-RF-SSQ-KS; KBS 6x20-RF consisting of:
- 4 pcs. Linear guide RNG 6-300-RF-SSQ-KS
- Two pcs. Cage KBS 6x20-RF

Order example 2
Set R 9-800/600-EG; AC 9x22; GC 9 consisting of:
- 2 pcs. Linear guides R 9-800
- Two pcs. Linear Guide R 9-600-EG
- Two pcs. Cage AC 9x22
- 8 pcs. End piece GC 9

Example recirculating unit



	Quantity	Type and size	Options
Recirculating units	150	NRT 26111	-GP
Preload wedge	150	NRV 26111	

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